the OIL AND GAS JOURNAL

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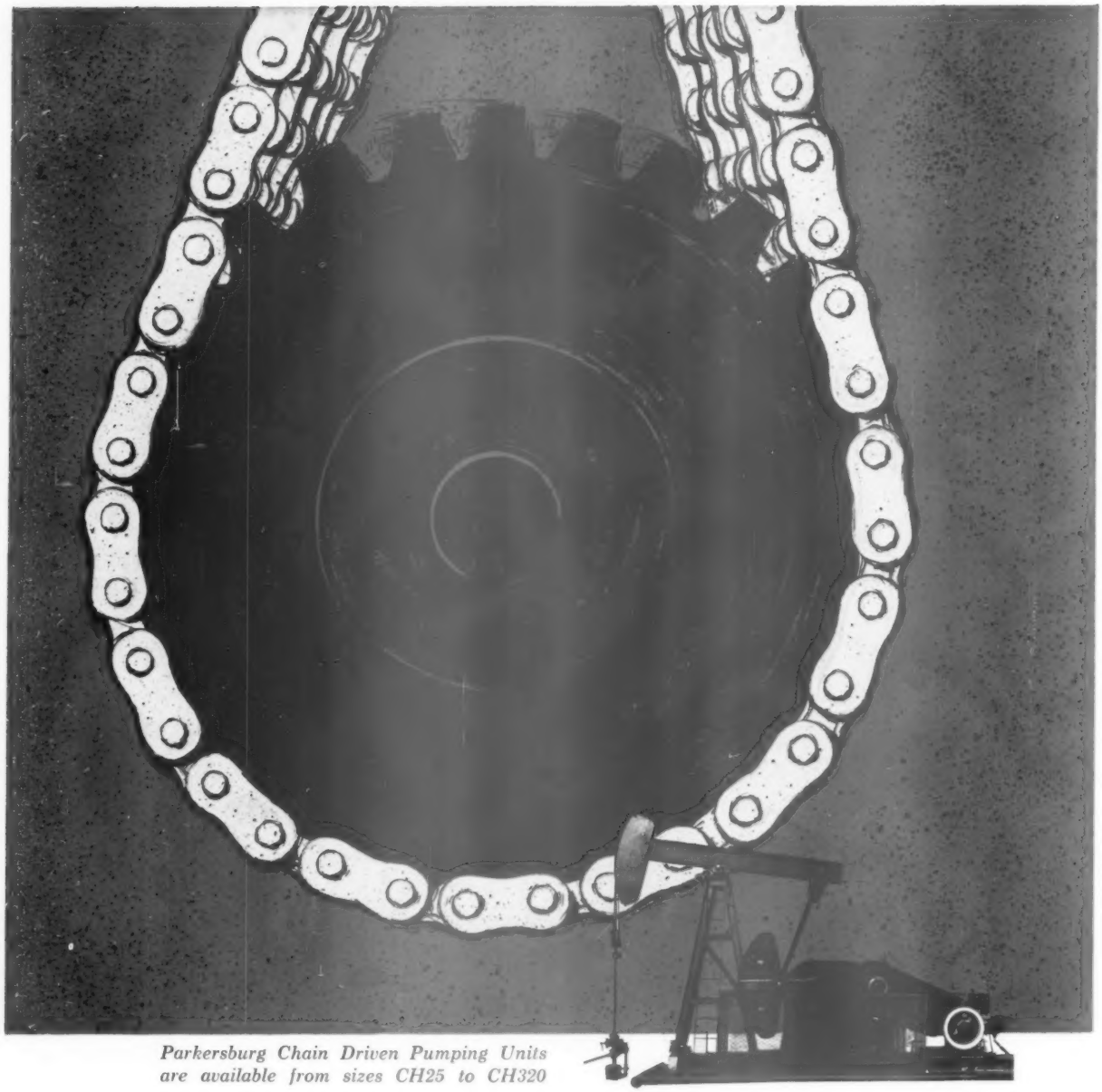

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Vol. 59, No. 48

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Technology

Drilling

Ocean-floor completions prove successful **80**

by Carl Lawrence

Western Offshore Drilling & Exploration Co. has done several jobs off California in recent months and has developed a five-step technique in drilling and completing a well underwater. Here's the technique which this company has developed for shallow-water, subsea completions.

Pipelining

Frozen holes provide LNG storage **84**

by H. C. Bozeman

Liquid natural gas is ready to go commercial. The last step, inexpensive storage, is now complete. It is technically possible and economically feasible to store the low-temperature liquid in frozen-earth cavities. LNG can now move into the gas markets in natural gas-poor countries and in peak shaving.

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by C. H. Connell and M. C. Forbes

Economic interests dictate that process industries choose water of lowest total cost. More than 30 industrial plants in the U. S. have chosen municipal waste water as a major or supplementary supply. Comparative costs in a specific locality can be determined only by on-the-scene engineering surveys.

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by W. L. Nelson

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Conoco's value-analysis program saves on maintenance **104**

by Kenneth Brooks

Over $100,000 a year is being saved on maintenance by Continental Oil Co. through its new value-analysis program, and the figure is growing continuously. Communications and evaluation are the keys to the program.

Foreman's page **112**

Many factors determine the design of fractionator internals.

THE OIL AND GAS JOURNAL **Newsletter**

November 27, 1961

Significant this week

Entire nation—outside of West Coast—was being converted into gasoline marketing laboratory last week.

Reason: spread of Gulftane, new Gulf combat grade, into more and more cities. Private branders and some majors have bitterly criticized Gulf's aggression.

Others think it's a smart move. All are wondering: what marketing pattern will eventually emerge? (p. 55).

Kennedy administration still hasn't developed definite long-range policy on oil-import controls.

That's fairly obvious from testimony of government witnesses at Steed hearing on imports last week (p. 64).

Workover rates are going up in South Texas and on the Gulf Coast. Increase of 17% is expected to take effect next month.

Well-service contractors say they have to put through such a raise—first since 1956—because labor and equipment costs are crippling them (p. 62).

Meanwhile, drilling contractors in South Texas, West Texas, and the Rockies are moving toward hourly wage raises for their crews (p. 62).

Drilling faces another so-so year, according to survey by Petroleum Equipment Suppliers Association.

Annual PESA forecast says rotary-rig activity and well completions in 1962 will be a little below this year's showing. But increase in footage drilled is expected (p. 61).

California contractor has worked out five-step technique for drilling and completing underwater wells.

Western Offshore Drilling & Exploration has used new method several times, and many other companies are expected to adopt it. Among advantages: Completion costs are reduced because no production platform is needed (p. 80).

Co-ops have been in the oil business for 2 decades, and now supply 20% of all fuels and lubes sold to farmers.

During these years the co-ops have branched out. Oil activities are no longer tied to farm markets alone. The co-ops (which altogether are as large as a major oil company) have gone on expanding in production, refining, and pipelining.

This growth record might suffer a setback, however, if new administration tax proposals go through (p. 58).

Nine Texas fields have been tagged for recovery projects. Altogether, recovery will be upped by 100 million barrels.

Railroad Commission has already given nod to one project—San Andres dolomite flood which involves more than 1,000 acres in Sharon Ridge field (p. 74).

California agency which must okay auto smog-control devices says they shouldn't cost over ½ cent a mile to operate.

On that basis, average motorist would pay $47 a year.

Although state pollution-control board has come out in favor of such a limitation, it hasn't taken any action to set cost (p. 68).

Geophysical contractors are in trouble, and the industry must decide whether it wants to see them stay above water.

So says Frank Goldstone, former chief geophysicist for Shell and now a consulting geophysicist in Houston. He thinks prices for such services may have to be raised (p. 140).

Weather may hold key to start on Interprovincial's extension from Hamilton, Ont., to Buffalo.

Bad snow season could delay work on 90-mile 12-in. crude line, approved recently by National Energy Board (p. 69).

In oil news abroad:

Italy's ENI will make its entry into United Kingdom's tough gasoline market with string of fancy outlets.

"Invasion" will be staged under command of prominent British businessman, restaurant specialist Charles Forte.

Forte, close friend of ENI boss Enrico Mattei, promises no products made from Russian crude will be sold in UK (p. 77).

News in the making

Heavy-fuel-oil injection into blast furnaces promises to open big new market outside U. S.

Jersey Standard-developed process is moving ahead rapidly in Europe. It's already being used commercially in Germany, Sweden, Italy, United Kingdom, France, and Belgium. Other users: Canada, Egypt, Australia.

Proposed Suwanee products line from Houston to Atlantic Coast may be built in 1962.

Big project is known to be in budgets of some of the eight major companies considering participation. Rumored size of line, which would compete with Plantation, ranges from 20 to 32 in.

Good news for drillers: regular pulsation dampeners will eliminate mud-stream pressure surges which cause lost circulation and damage drilling equipment.

Surges occur when mud pumps are run in some unusual way to get high pressures, low volumes needed for small-diameter deep drilling. Tests show dampeners remove most of the surge directly. Remainder is absorbed by long mud column inside drill pipe before it can get out into open hole and cause damage.

Independent tanker owners are depending more and more on hauling Russian oil from Black Sea.

Despite "black-list" warnings from oil companies after Cuba seized refineries for refusal to run soviet crude, western tanker owners have found Russian business irresistible.

Study by Weston Shipping Analysts of London says independents hauled 2,400,000 tons of oil out of Black Sea ports last year, and volume reached 1,600,000 tons in first half of 1961.

You can expect refining to keep on making big strides into the chemical business.

Main targets now are light olefins and aromatics. Refiner has advantages in producing these. He can buy crude oils that are high in aromatics; he has access to condensates and light hydrocarbons because of tie-ins with production operations and with gas-liquids-extraction plants in the field.

In addition, gases from cat cracking and other processing units make prime petrochemical feed stocks.

Crude-price cut in East Texas field has had adverse impact on giant field's pressure-maintenance program.

Recognizing this, Texas Railroad Commission is adjusting bonus allowable for salt-water reinjection. Before 15-cent price cut, operator earned 1 bbl. of bonus oil allowable for every 140 bbl. of salt water he reinjected. Price cut sent resulting compensation below break-even point.

Effective December 1, only 132 bbl. of salt water must be reinjected to earn the 1 bbl. of bonus allowable.

Operators in Texas' big Sharon Ridge and Coleman Ranch fields will be called on carpet for polluting Colorado River.

Colorado River Municipal Water District charges pollution is holding up construction of reservoir to supply water to Big Spring, Odessa, and Snyder. District is expected to petition Railroad Commission in early December for order to ban use of salt-water-disposal pits in area.

"Researcher obsolescence" is beginning to cause concern at some industrial laboratories. Oil shares this worry.

One committee is looking into possible arrangements for researchers to go back to school awhile if they've been away from graduate work for 10 years or longer.

Several integrated oil companies are understood to be submitting bids for Plymouth Oil at invitation of the company.

Deadline reportedly is end of November. There have been rumors of a $100-million price tag.

Market memo

Nov. 27, 1961

Lack of communications between oil marketers is one of the overlooked causes of the present market chaos.

Get any group of marketers together and they tell you that the **Tulsa and South Bend** antitrust cases have left their scars. **Company lawyers are advising** management to be overcautious in discussing prices.

The same antitrust fear—plus the onus of guaranteed margins—has caused many companies to **lose control over pricing policies** of their own jobbers and dealers. This makes it hard to prevent gasoline price fights or stop them once started.

Also, many recent sales, jobbers deals, and pricing innovations have left some hard feelings between top managements of several companies. A **vindictive mood** is abroad. The upshot is refusal by oil men to follow any leader.

This antitrust backlash comes at a time when all oil markets are oversupplied and individual companies are straining to keep up boom growth rates in spite of static demand.

That's why industry leaders have begun to urge top managers to give marketing problems their immediate attention.

V. A. Bellman, API vice president for marketing, says: "Today's acute marketing conditions will only be solved by intelligent decisions by managers."

New API Chairman L. F. McCollum says: "Company executives in the days ahead must give closer attention to their refining and marketing problems."

Another veteran marketer says privately that stability will return when managers:

(1) Cut refinery runs and keep them tight long enough to end oversupply even if they have to buy a little product here and there, **(2) realize** they can't show big percentage gains in sales every year, **(3) quit selling** products at a loss.

Feeling is growing among **lube-oil segment** that the industry's oil-drain recommendations are nearly untenable in face of auto manufacturers' claims for the 1962 models.

Many feel recommendations based on time used under certain driving and climatic conditions are more realistic than mileage. Nearly everyone's motor oil will do better than 2,000 miles without a change—how much more is debatable and depends on many factors.

A look at the markets—generally they're improving:

Gulf Coast—gasoline is firm in wake of heavy buying by Gulf Oil to cover losses at its strike-plagued Port Arthur refinery. Spot prices range from one-fourth to three-eighths of a cent off low postings of 10.75 cents for 90-octane. No. 2 is firm at 8.75-cent posting.

River—gasoline one-half to three-fourths of a cent off Gulf Coast low with No. 2 closely held at 8.5 cents.

Mid-Continent—gasoline considered fairly firm at 10.25 to 10.50 cents per gallon despite scattered discounting. No. 2 movement picking up with prices at 8.50 to 8.75 cents.

East Coast—distillates marking time awaiting cold weather. Gasoline continues its ups and downs in the various experimental price markets.

Good Wells Make Good News

Some Recent Frac Treatments That Gave Exceptional Results

November 27, 1961

Here are four recent examples of how Dowell engineers combined special materials and techniques with creative engineering to help operators get better than expected results:

- **Westmoreland County, Pennsylvania** (New Gas Well) Pay zones are the shallow Bradford and Tiona sands. Operator wanted to open more drainage area in this well than previous fracture treatments had opened in other wells in this area. He also wanted a decline rate slower than those of neighboring wells. Dowell designed a treatment using Waterfrac and high injection rates. First, the Bradford was fractured using 600 barrels gelled water and 28,000 pounds sand. Injection rate was 40 bpm at 2600 psi. Then, a wire line bridge plug was set and the Tiona was perforated and fractured. 700 barrels gelled water and 30,000 pounds sand were injected at 30 bpm and 2600 psi. *Before treatment, well produced 15,000 cfpd. 90 days after treatment, well was delivering 240,000 cfpd.*

- **Okfuskee County, Oklahoma** (New Oil Well) Pay is the lower Sonora sand at about 1230 feet. Other wells in the pool had been completed through conventional perforations and fractured with straight lease crude and 20-40 mesh sand. Production from these wells usually declined to about five bopd within two weeks. Frac sand also returned, causing pump repairs and cleanouts that often cost as much as $1000 per well. Dowell used Abrasijet® abrasive jetting service to cut notch at 1231 feet, then fractured using 5000 gallons lease crude with fluid loss control agent and 8000 pounds 10-20 mesh sand. *Well leveled off at 25 bopd and no sand troubles were encountered.*

- **Uintah County, Utah** (New Gas Well) This well is completed into a five-foot section of the Brushy Basin sand. Arasijet was used to cut two vertical notches in the casing between 7399 and 7402 feet. Dowell then fractured using water with a demulsifying agent added. First, 1000 gallons carried 250 pounds of sand and 10 gallons Freflo® to clean notches. Then 2000 gallons water without sand was injected as a spacer between sand and aluminum pellets to follow. The next 10,000 gallons carried 1470 pounds of aluminum pellets. Pellet concentration was increased during treatment from 0.02 to 0.20 pounds per gallon. Pressures during job ranged from 3600 to 4000 psi and injection rates varied from 31.0 to 11.5 bpm. Well made 1500 mcfd after treatment. *Other treatments in area using 20-40 sand as fracture prop had screened out.*

- **Midland County, West Texas** (Old Oil Well) This is a recompletion into the upper Devonian after the lower Devonian had been depleted. Production is from four sets of perforations between 11,504 and 11,646 feet. Dowell spearheaded Waterfrac with 3000 gallons BDA® breakdown acid. 60,000 gallons gelled water and 116,000 pounds sand were injected in two equal stages. 3000 gallons regular acid was injected between stages and 4000 gallons Retarded Acid injected after last stage. *After treatment, well flowed 946 bopd through a ⅜" choke. Well-head pressure was 1750 psi and gor was 2807.*

Ask your Dowell representative for suggestions about how to get better production from your wells. Dowell services and products are offered in North and South America, Europe, North Africa and Iran. Dowell, Tulsa 14, Oklahoma.

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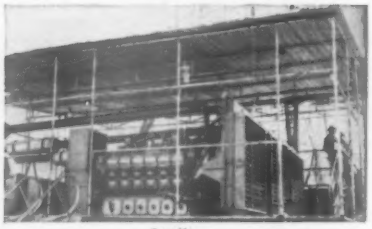
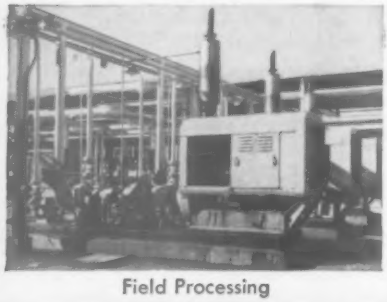


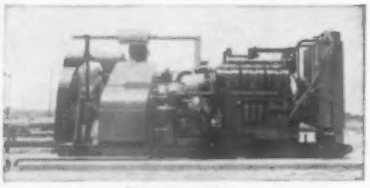
Drilling

Generator Drive

Pipe Line

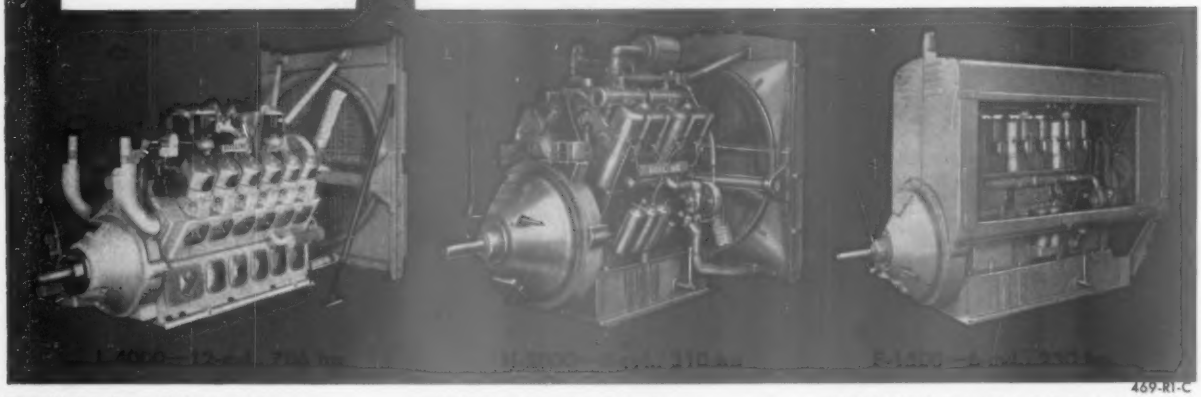


Field Processing



Repressuring

Transport



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CALIFORNIA, Long Beach and Bakersfield Engine & Equipment Company
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OKLAHOMA, Oklahoma City and Tulsa Carson Machine & Supply Co.
PENNSYLVANIA, Pittsburgh, P. C. McKenzie Company Bradford, R. R. Reck Company
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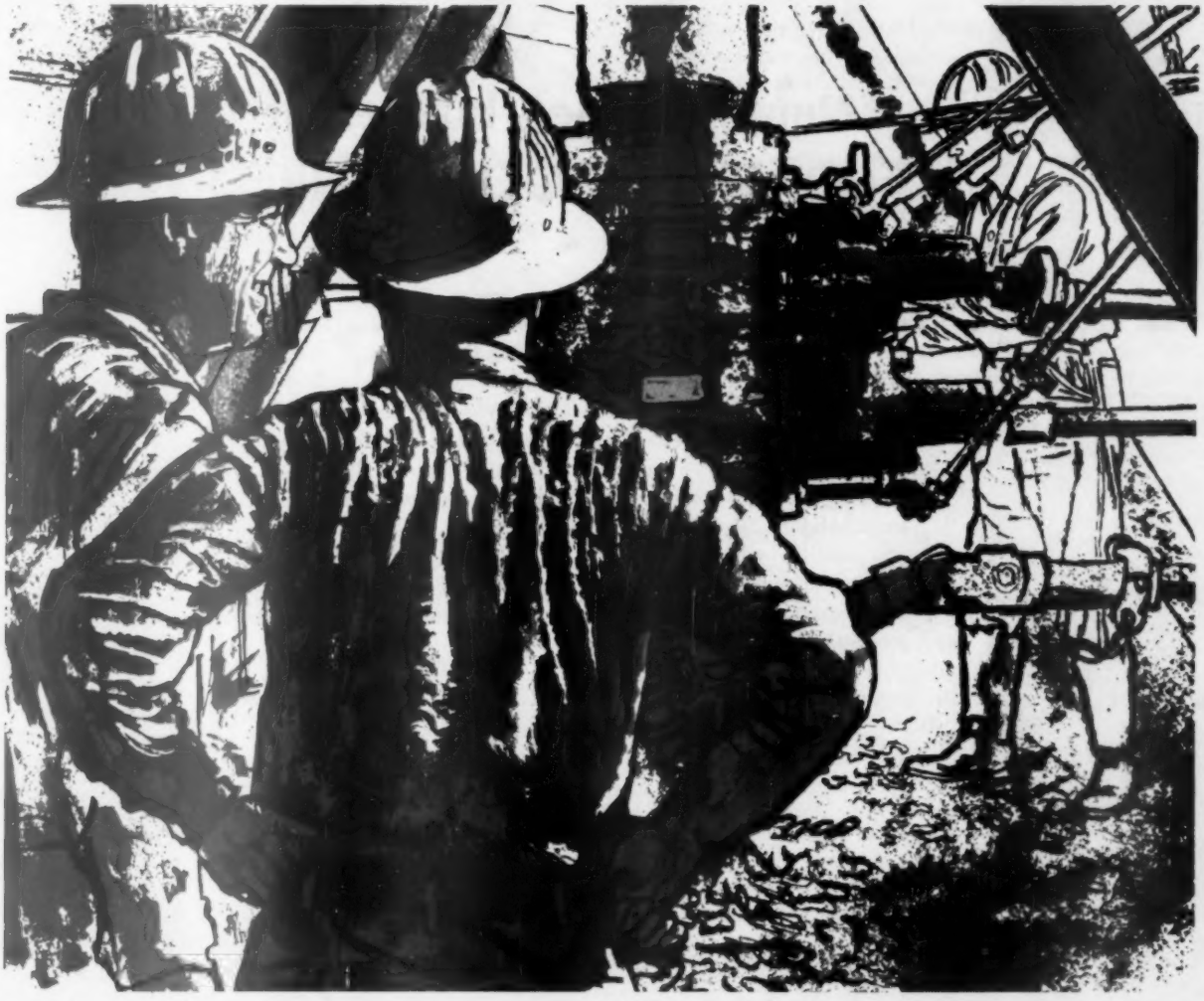
PROTECTION IN DEPTH

How it helps cut compensation costs



How well are your men equipped to handle a blowout?

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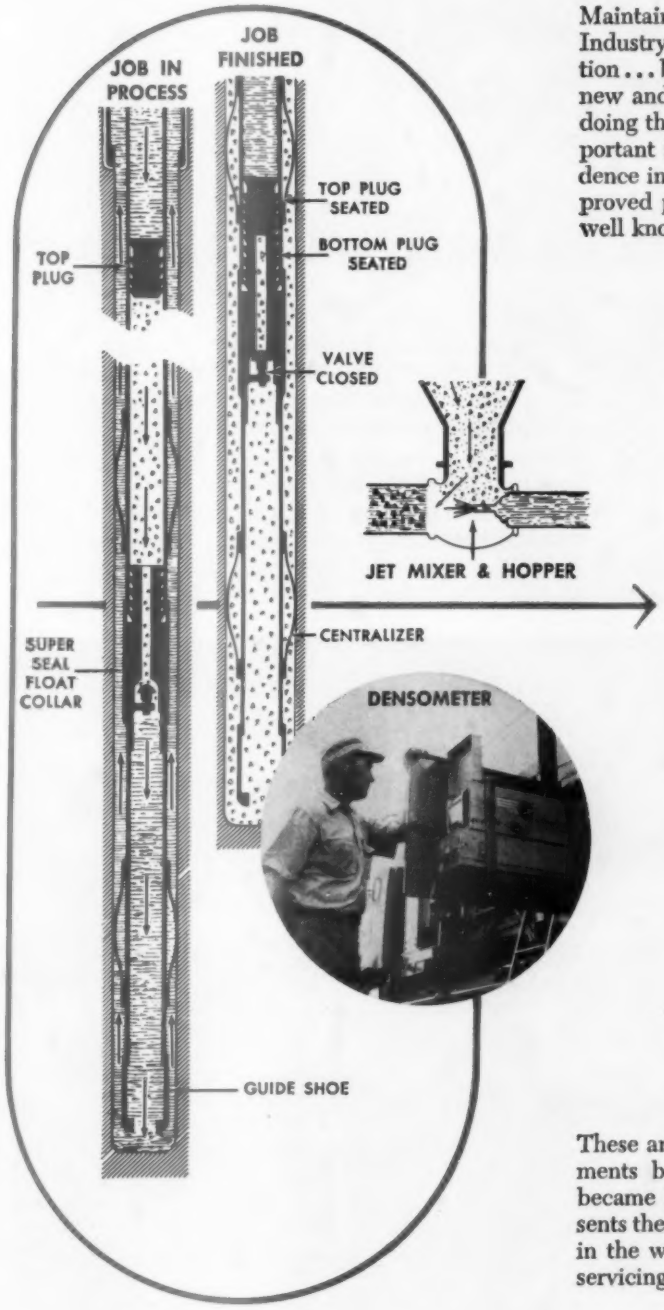

Maintaining leadership in the field of service to the Petroleum Industry depends not only on day-to-day customer satisfaction... but also on continuing development of new ideas... new and better equipment and products... better ways of doing things. By selecting Halliburton, the leader in this important field, the Petroleum Industry demonstrates a confidence in our ability to consistently produce *more* of the improved products and methods it has come to expect. Some well known examples of this ability are...

THE HALLIBURTON JET-TYPE MIXER revolutionized oil well cementing in the early 1920's by providing a means of continuous, hydraulically mixing and proportioning of cement on the job. The latest models capable of mixing a maximum of 50 sacks per minute with water-cement ratios ranging from 3½ gal. per sack upward are in service today all over the world.

THE HALLIBURTON TWO PLUG METHOD with a bottom 5 wiper rupturing diaphragm plug leading the cement slurry helps to provide a better primary cementing job by wiping the casing clean as it moves down the pipe... and a top 5 wiper solid plug following the cement down to the pressure-ruptured diaphragm bottom plug causes a shut-off of fluids being pumped into the casing. Landing of top plug lessens the possibility of further cement displacement and provides a better bond of cement around the bottom of the casing where it is required.

THE HALLIBURTON DENSOMETER provides a continuous reading of cement slurry density in pounds per gallon... density of a given sample is indicated within 10 seconds and data is permanently recorded on a visual strip chart. This new instrument is installed on Halliburton mobile cementing units for better control of cement slurry strength and pumpability characteristics as a means toward better primary cementing jobs.

These are only a few examples in the long line of developments begun nearly 40 years ago when Halliburton first became known in the oil fields. Today, Halliburton represents the largest, most efficient oil field servicing organization in the world... and the facilities of the entire Halliburton servicing team are as near as your telephone.

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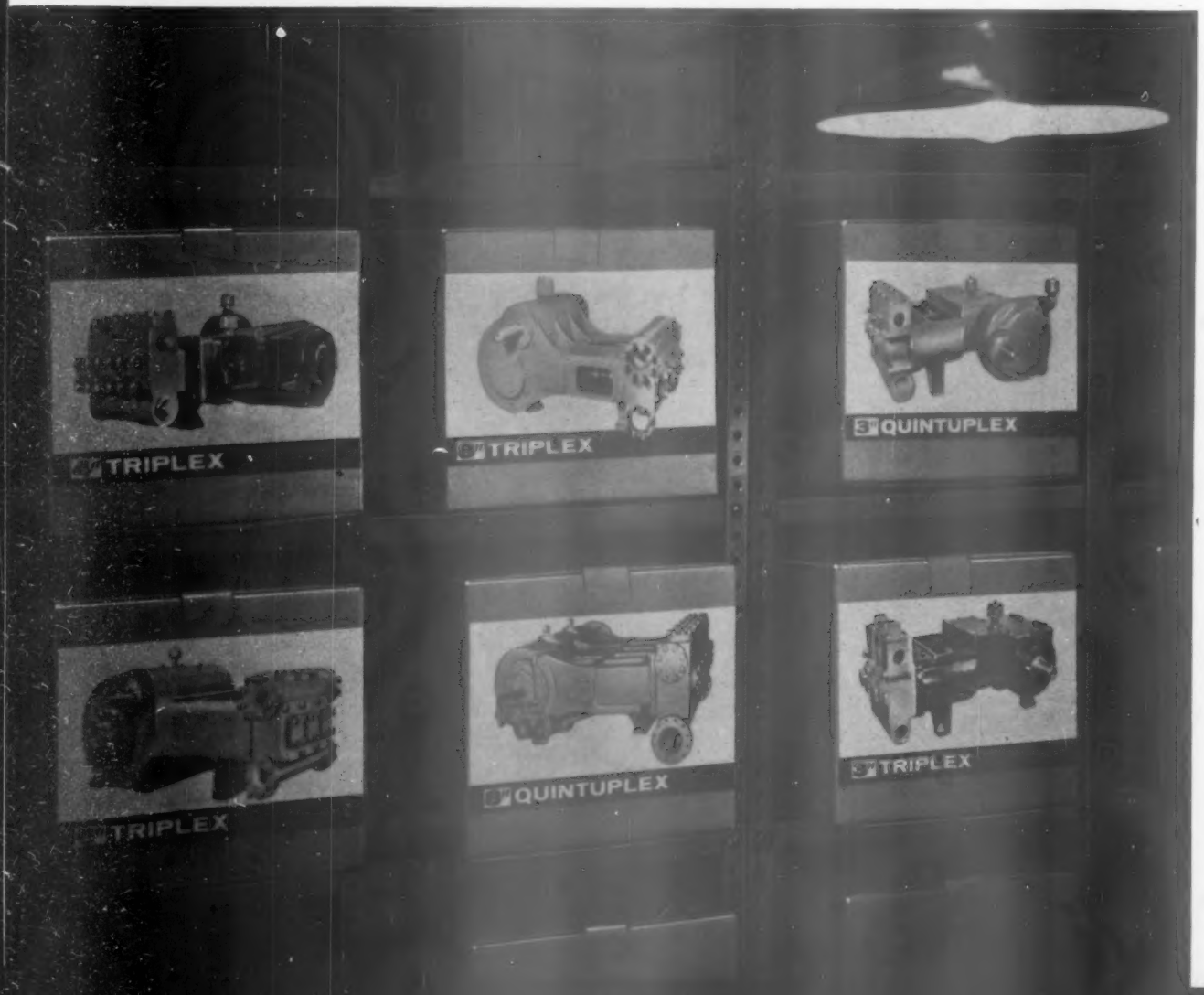

We never shelve service problems

You'll never find an "Oilwell" Pump Specialist on the shelf, because his business is *field service*. You will find him hard at work all over the oil country. His assignment is to help you plan for proper conditions to assure best pump operation. He knows his way around all the subtleties of liquid characteristics; elevation; intake piping size and arrangement; and intake pressure-speed relationships. Considering the cost of a mistake in horsepower, capacity, pressure requirements or a handful of other intricacies, it's worth your while to take advantage of your "Oilwell" Pump Specialist's services. He's there to de-bug your operation, and one of our ways of making sure that when you buy "Oilwell" equipment, you get a lot more than our product.

How to get fluid end part replacements fast

"Oilwell" stores stock a complete range of fluid end replacement parts including Co-Hard plungers, valves and seats, stuffing box packing and parts. Replacement is no further away from you than your nearest "Oilwell" store because we make sure we'll have what you need on our shelves *when* you need it. Our store managers are there to help with pumping problems, too, and you'll find their long experience to be valuable in practically any producing problem.

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'62 Chevrolet

*Based on prices in the National Automobile Dealers Association USED CAR GUIDE, recent-model Chevrolets are now bringing a higher percentage of their original price than any other full-sized car in their field.

Here are all the fleet car advantages you've come to expect from Chevrolet—plus new refinements that promise even higher return at trade-in time.* Who else in Chevrolet's field, for instance, gives you the trip-shortening comfort of Full Coil cushioning at each wheel, aided and abetted by more than 700 sound and vibration filters? Or a whopping deep-well trunk (with bumper-level loading) that lets you take on odd-shaped samples and paraphernalia you used to have to leave behind? And more, much more: oversized, wide-opening doors designed with big six-footers in mind. Roomy new Body by Fisher interiors. Standard Hi-Thrift 235 Six and Turbo-Fire 283 V8 triggered to do special things with regular gas. And, for extra long-term protection of your fleet investment, new steel front fender underskirts help put a stop to rust. *Even the mufflers are longer lived this year to help cut maintenance cost.* It will pay you to check out all the dollar-saving details at your Chevrolet dealer's first chance you get. . . . Chevrolet Division of General Motors, Detroit 2, Michigan.

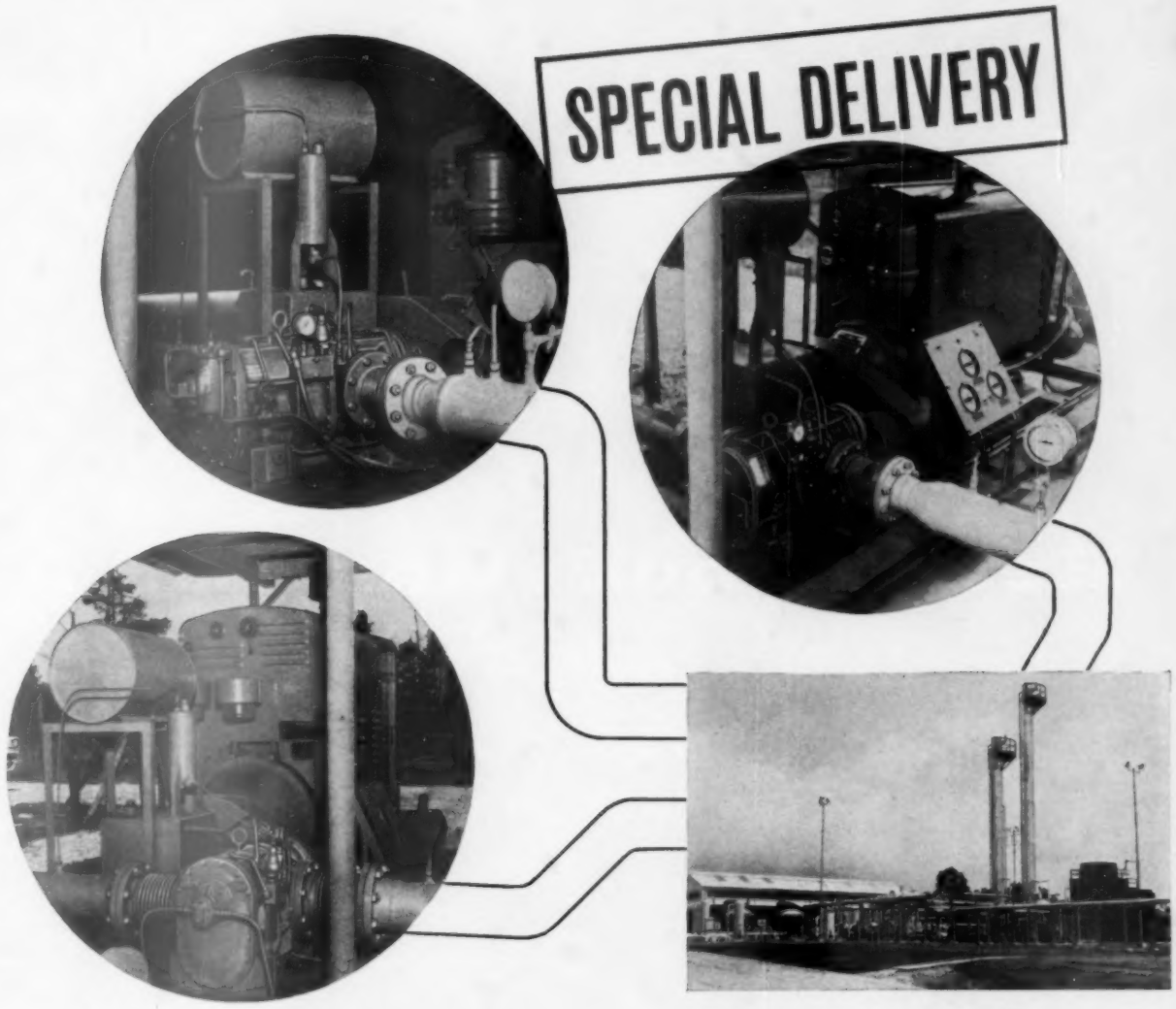
CHEVROLET

2-Door Bel Air

the new CHEVY II basic fleet transportation in a totally new line of cars

Chevy II 100 4-Door

This one might just fit your special fleet requirements like no other car ever has. It's built in a new runabout size with a rugged new kind of unitized body to save you money in maintenance. You have a choice of a frugal four or satiny six in most models. Durable new Mono-Plate rear springs make the Chevy II ride a study in smoothness. And just wait till you get the low-down on that price tag at your dealer's!



Axi-compressors gather gas for SHELL

Three packaged Axi-compressor plants—the first of their type in natural gas field service—deliver gas from long gathering lines to the Shell Oil Company's gas processing plant at Little Creek, Mississippi.

Installed out of doors, with only a roof shelter, these compact skid-mounted units are complete with natural-gas engine drive and all auxiliaries, permitting exceptionally low installation cost.

One of the Axi-compressors is a 438 cfm unit operating at 2920 rpm and gathering gas from 12 wells. The other two are 218 cfm units operating at 3060 rpm, one gathering gas from 4 wells and the other from 7 wells. All are designed for 25 psia inlet pressure and 50 psia discharge.

These positive-displacement axial-flow rotary compressors are well suited to this type of service because of their small size, light weight, high sustained efficiency and freedom from vibration and pulsations. No lubrication is required in the compression chamber and the gathered gas is free from oil vapors.

Axi-compressors are now available in both low and high pressure designs, for capacities from 100 to 18,000 cfm. Ask your Ingersoll-Rand engineer for complete details.

Ingersoll-Rand®

275A17 11 Broadway, New York 4, N.Y.

THE WORLD'S MOST COMPREHENSIVE COMPRESSOR EXPERIENCE

Helpful bulletins on.....

. . Portable waterflood units
Cabot pumping units
J&L casing and tubing

Production costs can be cut with J&L equipment. If it's sold by J&L . . . it's the best available, and in every instance information is ready . showing how and why. Call your local J&L Supply man or write us at Tulsa, 1431 South Sheridan Road.

J&L SUPPLY

Jones & Laughlin Supply Division « Tulsa

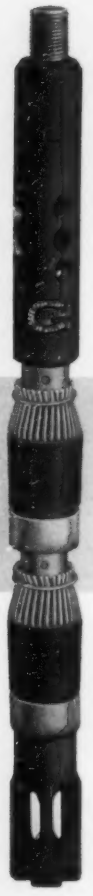
CHOOSE FROM A COMPLETE LINE . . . Another reason why you get more value with Guiberson . . .

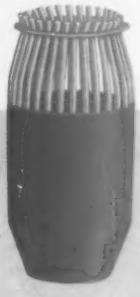
Sure, there's a difference!

Dress your swab with genuine Guiberson cups and see for yourself.

You wouldn't wear a tux in a ball game, or overalls at a formal dance — and, for successful swabbing, it's more important that your swab be correctly dressed to suit the conditions. Guiberson, and only Guiberson, offers a selection from nine types of cups and suitable swabs in sizes ranging from 1" through 13⅜".

In most tubing swab jobs, one of three types of well-proved, service-certified Guiberson cups will give superb performance.





Type J

Flexible, strongly reinforced for repeated runs under heavy loads in deep wells.

Type L

More flexible, for medium or heavy loads in wells of any depth.

Type GW

Even more flexible, for light to medium loads in shallow wells, stripping light loads in wells of any depth, and for use in rough or deformed pipe.

Swabbing in oil, water, or acid-water, these cups last and last and lift fluid at a rate that assures a profitable operation. It stands to reason that, with the many variables possible in swabbing, no single type of cup or swab can give maximum performance under all conditions. If you have a special problem, your Guiberson representative will gladly recommend the combination of cups and swab best suited for your particular situation. Supporting his selection is the experience and integrity of the first and foremost swab manufacturer in the world.

Better be Safe than Sorry — go Guiberson

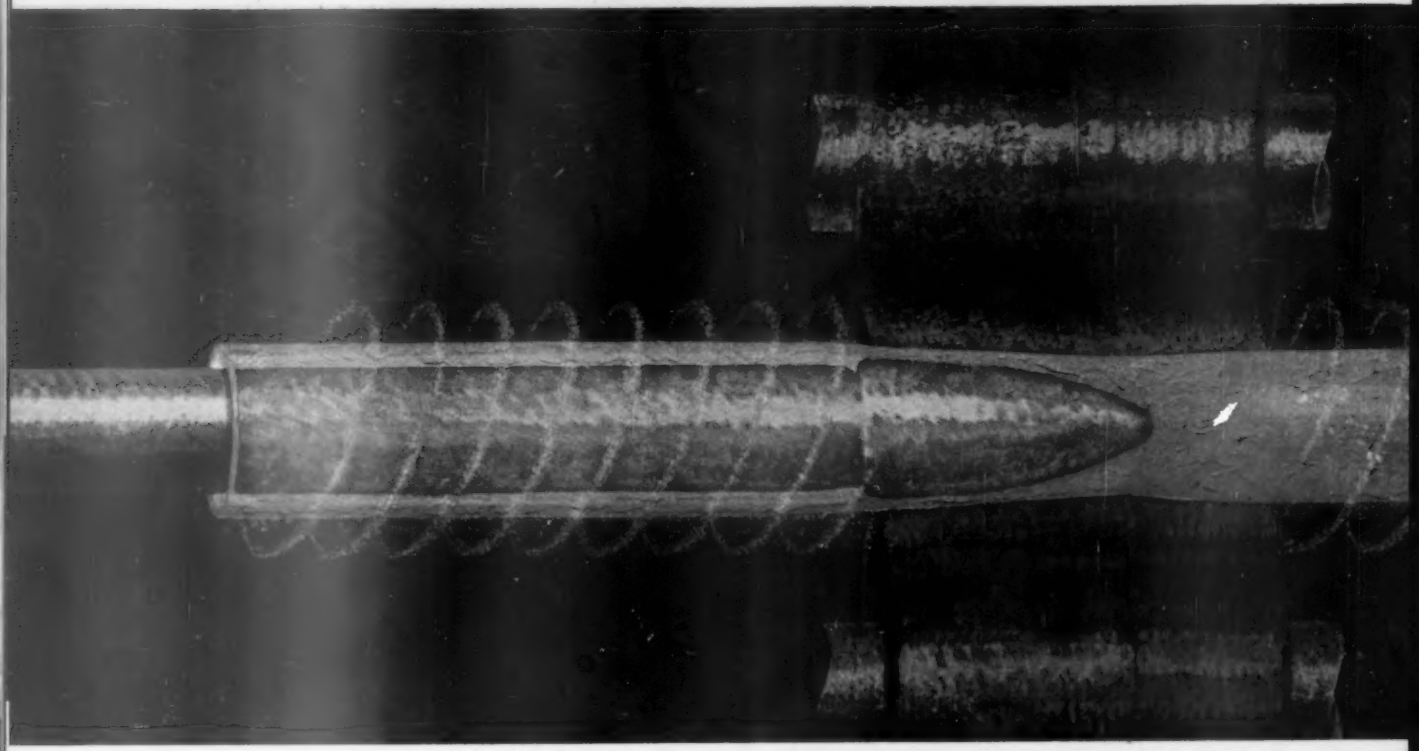
THE GUIBERSON CORPORATION
DALLAS, TEXAS, U. S. A.

PRODUCTION, DRILLING AND WORKOVER SPECIALTIES, MOLDED RUBBER PRODUCTS

DRESSER INDUSTRIES INC.

OIL • GAS • ELECTRONICS
CHEMICAL • INDUSTRIAL

What a tough way to come into the world!



The piercing operation is one of the first steps in creating seamless tubing from a solid section of steel. After we set the hot steel billet in place, we ram it. Spin it. Push its insides out. And stretch it into a tube many times longer than the original piece of steel.

Consider the grueling way USS National Seamless Pressure Tubes are made and all the rigid tests to pass before we'll ship. You can see why they are the strongest, safest refinery tubes you can buy. Contact your National Tube Distributor for USS National Seamless Pressure Tubes. *USS and National are registered trademarks*

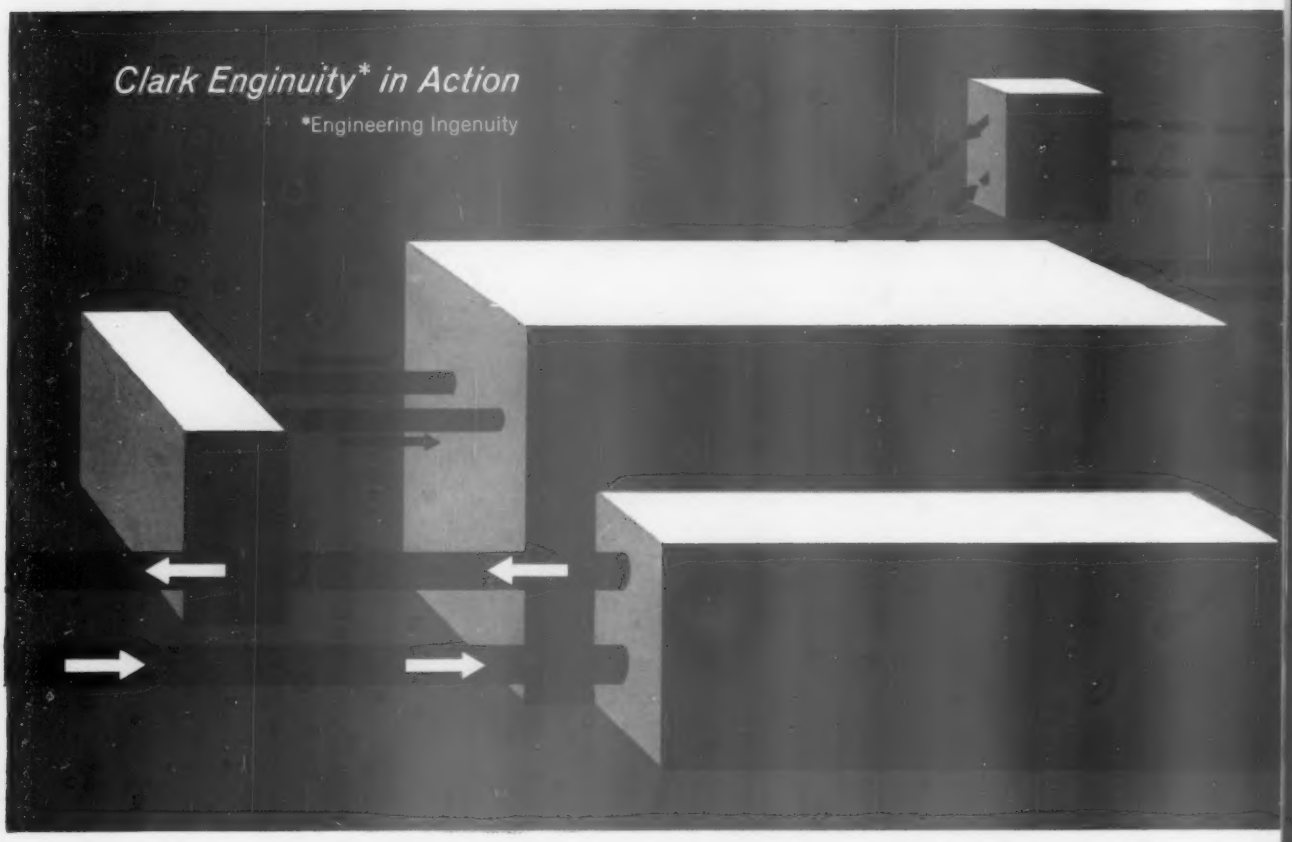
Steel

This mark tells you a product is made of modern, dependable Steel.

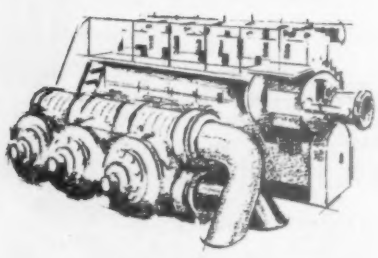
USS

National Tube Division of United States Steel

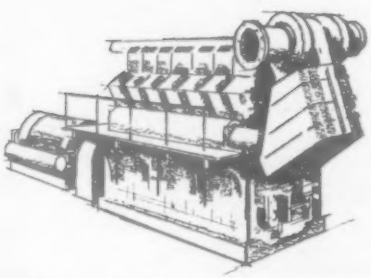
Columbia-Geneva Steel Division, San Francisco
Pacific Coast Distributors
United States Steel Supply Division
United States Steel Export Company, New York



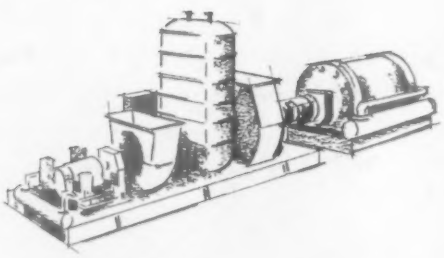
New CLARK MODULAR SYSTEM takes big bite out of compression costs



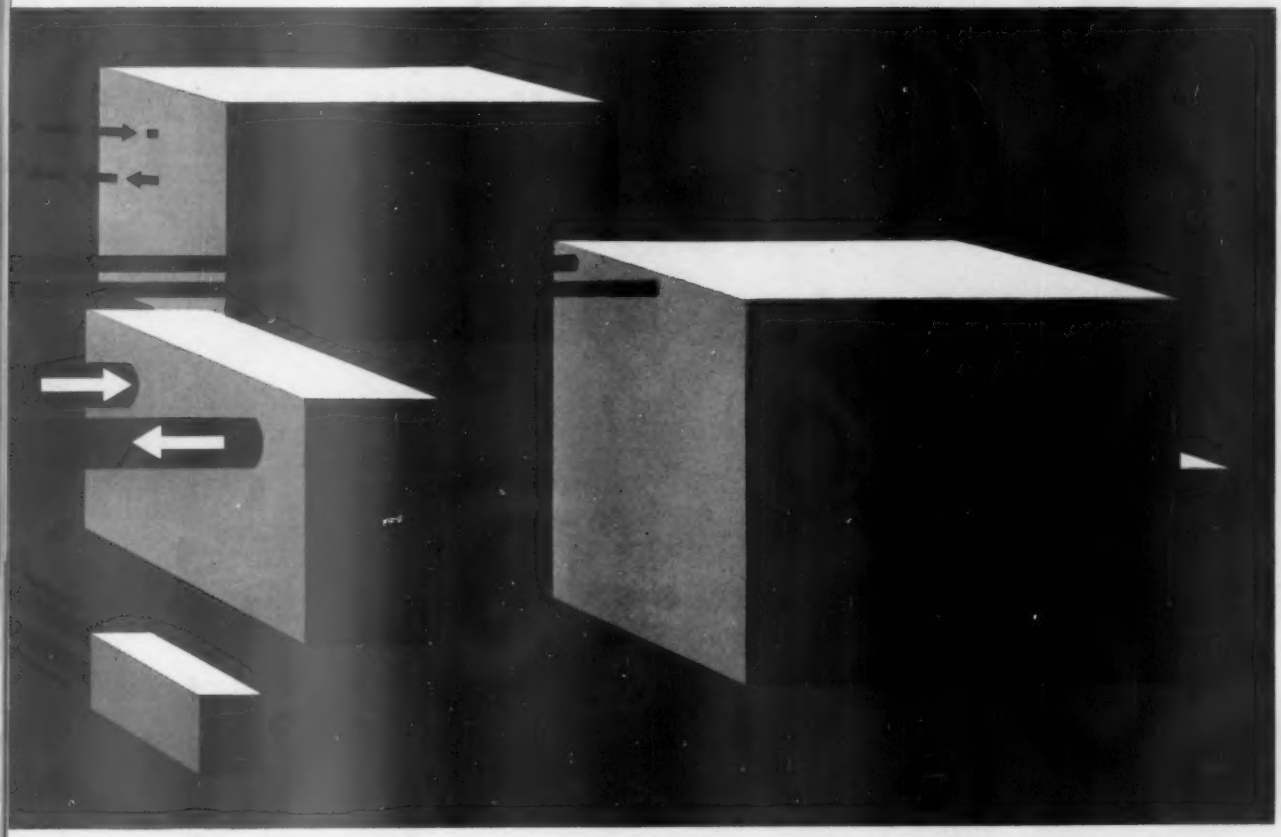
In-Line Gas-Engine-Driven Compressors.



Gas-Engine-Driven Centrifugal Compressors.



Gas Turbine Compressor Units.



Compressor station equipment in modules—That's the latest big news from Clark . . . and it's your cue to one of the soundest, most far reaching proposals ever made for reducing compressor costs.

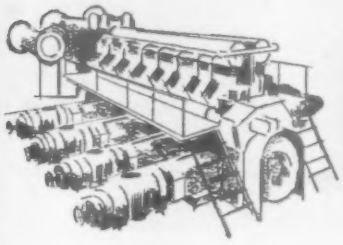
Here's how the Clark modular system works—Taking a look at high compressor station costs, particularly the expensive field labor required to install all the equipment, Clark engineers came up with a bold new manufacturing plan to help operators save money: First, arrange station equipment into related modular systems. Second, engineer and fabricate each module *completely* at the factory under controlled shop conditions and with efficient labor. Third, ship the modules to the job site, ready for quick, easy hookup.

Substantial all-around savings—Startling in its simplicity, the Clark *Modular System* offers numerous opportunities to cut costs. Here are a few:

- Pre-engineering drastically reduces the user's engineering workload and cuts down elapsed time from project go-ahead to startup.
- Field fabrication is sharply reduced. Just locate modules and run piping to and from the driver.
- Delays and other hazards of "cut and try" field installation are eliminated.
- Each module is complete within itself, not dependent upon other systems for satisfactory operation.
- Orientation and location of modules can be varied to suit any installation or terrain requirement.
- The modular system permits compressor installation on a simple, easily poured concrete slab.
- Additional compressors with their accompanying modular auxiliaries can be readily and quickly installed as the station expands.

Sound interesting? Your nearby Clark representative has a remarkable story to tell, complete with facts, figures, engineering drawings and economic comparisons. Contact him today.

CLARK BROS. CO., OLEAN, N.Y.



V-Type Gas-Engine-Driven Compressors.

CLARK

DRESSER INDUSTRIES INC.

OIL • GAS • CHEMICAL
ELECTRONIC • INDUSTRIAL

A working partner in allied industries

PODBIELNIAK — *Centrifugal Contactors, Distillation Apparatus, Instrumentation*

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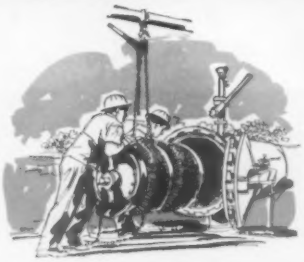
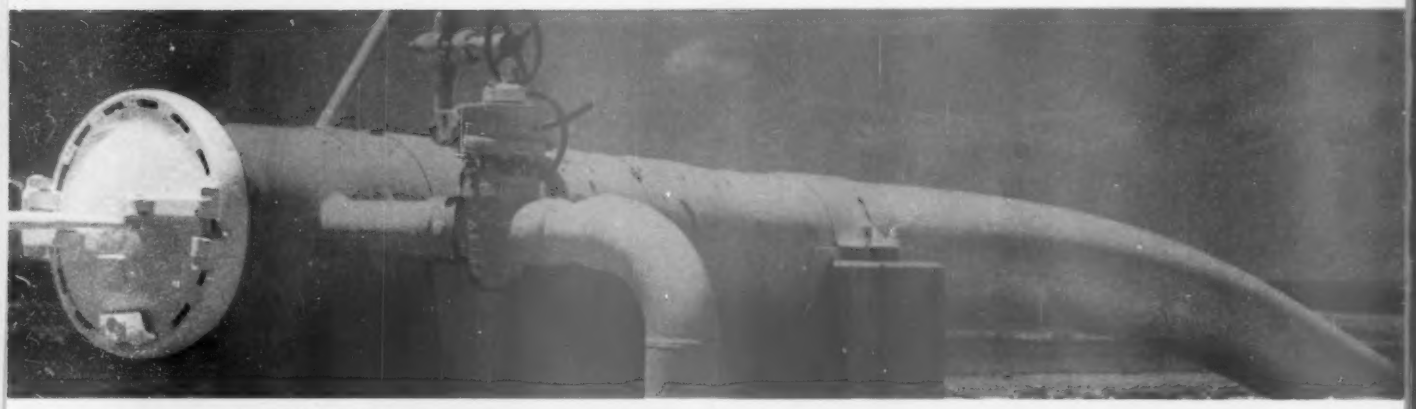
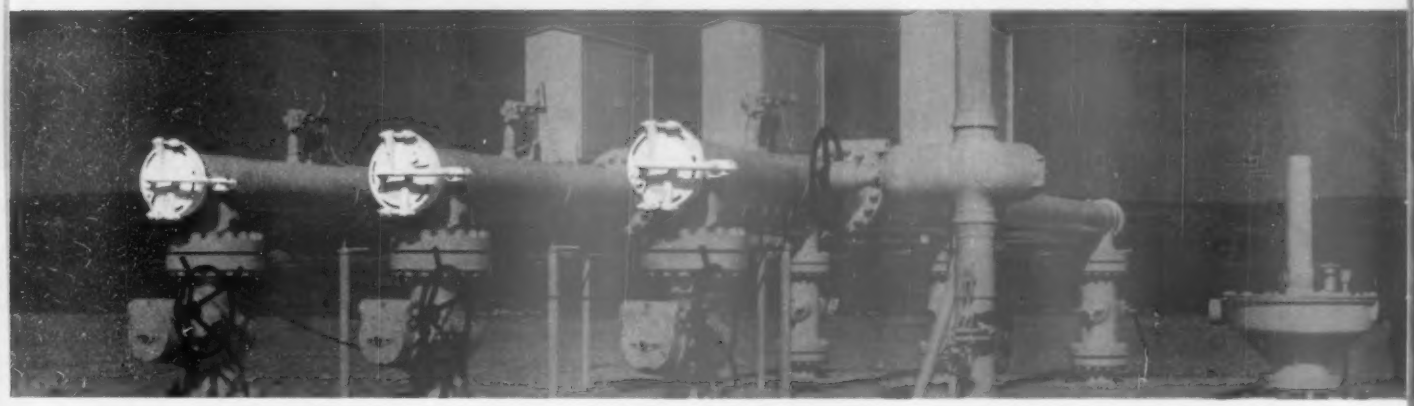
Read "between the pipelines"





UNIBOLT Hinged Closures started a new trend in pipeline scraper traps . . . greatly simplified the sending and receiving of pigs. Release only two bolts and this closure swings open and shut on a sturdy hinge. The self-sealing resilient gasket seldom, if ever, needs replacing.



These are UNIBOLT Hinged Closures on a gas pipeline meter manifold. They permit easy access to the meter runs for inspection and cleaning.

(Left) Gas pipeline blowoff head equipped with UNIBOLT Closures on a cantilever hinge for easy opening. A bleeder plug is provided for safely relieving pressure that may leak thru the riser valve. (Right) UNIBOLT Welding Neck Couplings in a products pipeline manifold. The cross-overs are equipped with a half-coupling which interchanges with blanking plugs on the risers. This arrangement eliminates many valves and insures against commingling of products.

UNIBOLT

THORNHILL CRAVER CO.

P. O. Box 1184, Houston, Texas

Du Pont *Petroleum Chemicals* News

Number 111 in a series of bulletins for the Petroleum Industry NOVEMBER • DECEMBER 1961

WHICH ANTIKNOCK for standard, compact and economy cars; low or high compression; stick-shift or automatic transmission; 4, 6 or 8 cylinders — straight or V; research, motor or road octane rating? Like today's superhighways, there is a road to almost every destination. The problem is WHICH ONE?

Finding a path through today's antiknock maze

A recent Du Pont study showed one refiner how he could save $19 per 1,000 barrels of regular gasoline and $64 on premium by changing antiknocks.

Another could save $15 on regular and $20 on premium.

The Du Pont studies that made these success stories possible may help YOU *sort out the variables that control antiknock selection today, yielding the octane rating you want at the lowest price possible.*

Wilmington, Del.: The Du Pont Petroleum Laboratory is currently in the midst of a continuing program comparing the antiknock performance of TML, TETRAMIX* lead alkyl mixtures and TEL in a variety of fuels.

These studies have already paid off for a number of refiners, by showing which of the many available antiknocks can do the best job of octane improvement *per dollar spent.*

As refiners are well aware, the performance of the "new" antiknocks varies greatly from fuel to fuel and from engine to engine. Road octane values can differ greatly from Research and Motor octane results. Consequently, a full testing program must be conducted on every fuel before the refiner can safely say, *"This* antiknock is best for my fuels."

*Trade Mark

Du Pont's continuing research provides such assistance.

PROBLEM: How Volatile?

The gasoline you sell to the driver of a stick-shift, 4-cylinder compact may need a different antiknock than that used in an automatic transmission V-8. The Du Pont study has thrown dramatic light on the significance of the differences in volatility of TML, "TETRAMIX" and TEL—and the need for greater volatility in the fuel distribution systems of certain groups of cars. TML and "TETRAMIX" are more volatile than TEL, and have clear-cut advantages in attaining desired Road Octane values in such automobiles.

PROBLEM: What Concentration?

Further results of our studies show that, of the new antiknocks, TML is generally most useful in manual transmission cars with fuels having low front end octane quality. "TETRAMIX" provides advantages over TEL in a variety of fuels, its advantage increasing at higher octane and lead levels and higher aromatic contents.

PROBLEM: How Many Dollars?

Out of all this research comes the practical advantage of learning exactly which antiknock will work best in your fuel on the basis of overall cost. As a rule, the study indicates that TEL is still the most economical antiknock with respect to both Research and Road octane number in most fuels, with "TETRAMIX" proving best for a significant number of fuels and TML winning out in isolated cases.

More Details Available

Our Petroleum Laboratory is prepared to share this study with oil refiners and marketers, and to work individually with you on choosing the most economical antiknock for your fuel. For further details, contact your Du Pont representative.

Computers speed research and results: This computer complex at the Du Pont Petroleum Laboratory is an integral component of many of our basic research studies, such as the effect of various additives on combustion chamber flame speed. By encoding and recording directly from the equipment under test, a great mass of test data is rapidly analyzed. From these data stem experience in the way fuel composition variables affect performance and economy.

ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

OVER ▶

Du Pont *Petroleum Chemicals* News

R. O. BRAENDLE is Head of the Engineering Division, Du Pont Petroleum Laboratory.

Dick joined Du Pont in 1944. One of his early assignments was development research on grease thickeners. In 1950, he moved to the Company's Experimental Station in Wilmington. Two years later, he moved again – this time to market research analyst in the then Technical Section of the Petroleum Chemicals Division. In 1955, Dick became assistant to the Additive Sales Manager and, in 1956, was named Manager, Additives, of our Mid-Continent sales group. A two year stint as Technical Manager, Eastern Region followed in 1958. He came to the Petroleum Lab in early 1960, to head the Chemical Division. Later that same year he assumed his present responsibilities.

A recent indication of the breadth of his current research was contained in the Philadelphia Section-ACS talk he gave last March on "New Lead Antiknock Agents", a report of a continuing research program conducted by his group.

Dick is a graduate of MIT. He and his family live in Wilmington.

New Product Bulletin

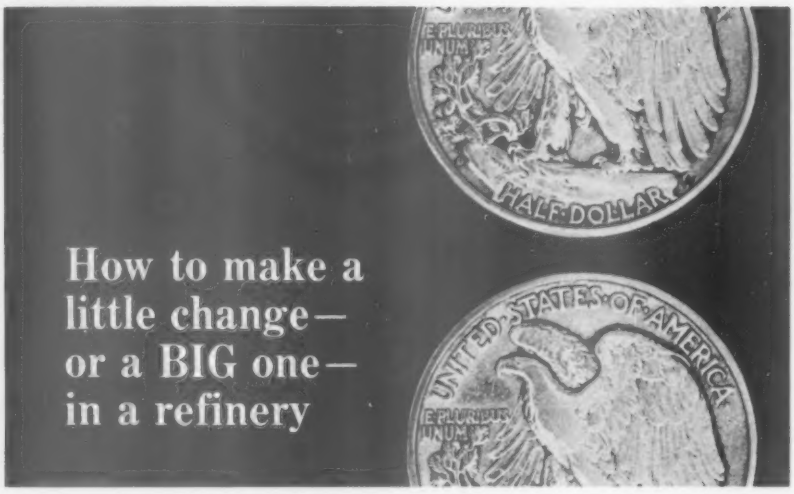
describes DMA-4, Du Pont's multifunctional additive.

Now off the press, this new bulletin gives detailed information on the characteristics and functions of this versatile gasoline additive.

Carburetor detergency is perhaps the most striking performance value you gain with DMA-4. It cleans carburetors and *keeps them clean.* You'll find photos of various test results in the bulletin. DMA-4 also offers:

- *Anti-stalling properties.* DMA-4 sets up a protective film that makes throttle plates and other internal surfaces water repellent, thus preventing stalling due to ice formation on cool, damp days.
- *Rust prevention.* The protective film also protects metal surfaces (engine parts as well as pipelines and storage tanks) from corrosion.
- *Phosphorus credit.* DMA-4 contains phosphorus compounds of the type helpful in suppressing surface ignition and spark plug fouling caused by combustion chamber deposits. The concentration of other phosphorus additives can, therefore, be reduced proportionately to obtain minimum treating costs.

For a copy of this useful new bulletin, contact your Du Pont Petroleum Chemicals representative.



How to make a little change— or a BIG one— in a refinery

We occasionally like to point with pride to accomplishments of our various petroleum services, such as the time we helped a refiner realize an additional dollar on every barrel of a component by suggesting a change in its end use.

A recent by-product in Du Pont linear programming is taking us into the area of helping refiners to evaluate *capital equipment* changes, in addition to the more common studies of processes and components.

For example: not long ago, a refiner asked us to weigh the pros and cons of his adding an alkylation unit. In another case, the equipment in question was a coker.

In both cases, we were able to help by combining the refining experience of our people plus the mathematical capacity of the most modern electronic computers, to analyze the complete refinery and then evaluate the relative economic effects of making changes in process or equipment.

Such use of linear studies is a natural outgrowth of our basic investigations of blending, inventory and other refining problems.

Your Du Pont representative will be glad to tell you more about the advantages of Du Pont linear programming.

TELEPHONE NUMBERS FOR SALES OFFICES

	Area Code*	Telephone No.
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8 S. Michigan Ave.	312	RA 6-8630
Houston 2, Texas—		
702 Bank of Commerce Bldg	713	CA 5-1151
Los Angeles 17, California—		
612 S. Flower St.	213	MA 4-1354
New York 20, New York—		
45 Rockefeller Plaza	212	CO 5-2342
Philadelphia 2, Pennsylvania—		
3 Penn Center Plaza	215	LO 8-3531
Pittsburgh 22, Pennsylvania—		
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1811 South Baltimore Ave.	918	LU 3-8581
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Du Pont of Canada, Limited Petroleum Chemicals, 85 Eglinton Avenue, East	416	HU 1-6461
Other Countries		
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Organic Chemicals Department Export, 7451 Nemours Building		
Petroleum Chemicals Division	302	PR 4-5009

*for Long Distance Dialing

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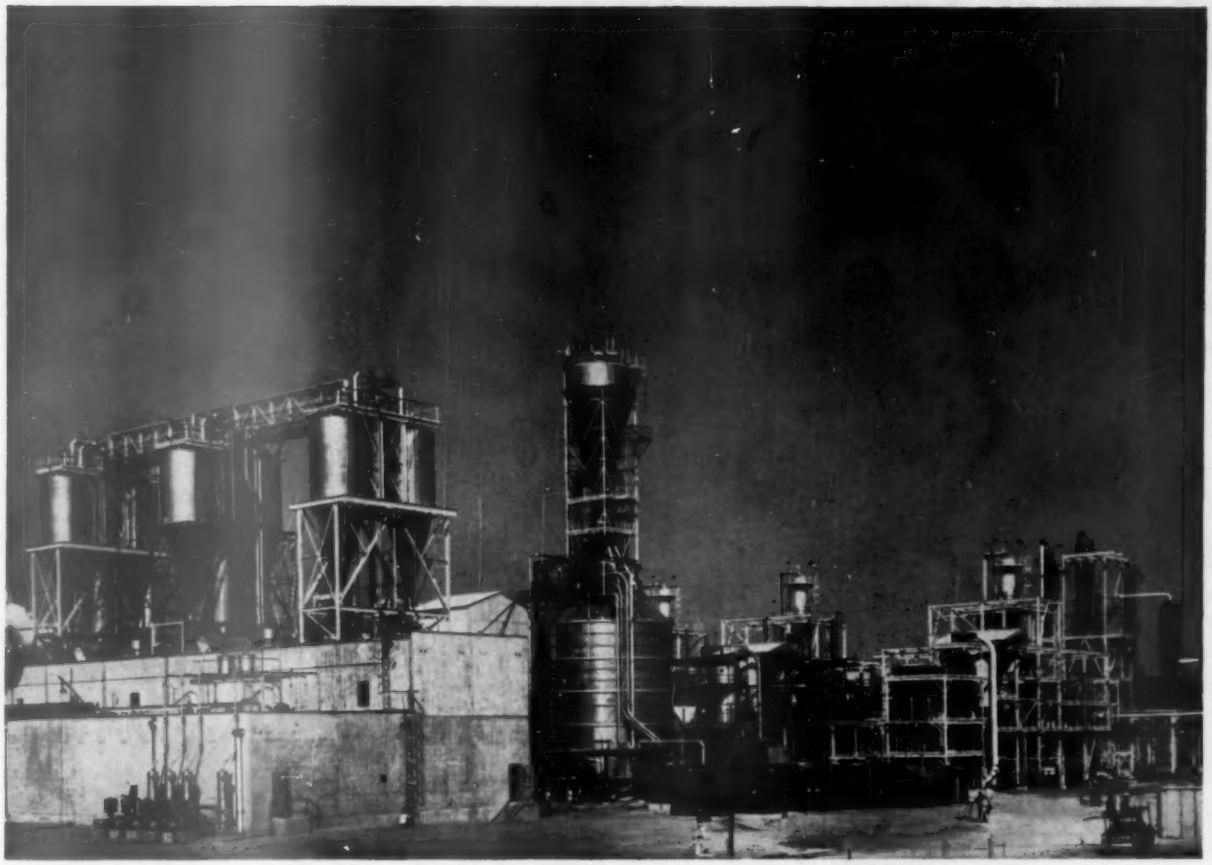
Better Things for Better Living
. . . through Chemistry

Du Pont Antiknocks and other Petroleum Additives

OVER

ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

Printed in U.S.A.



AviSun creates a new source of polypropylene

AviSun Corporation's recently completed plant, now operating near Wilmington, Delaware, provides a major addition to the nation's polypropylene production.

The plant adds 100 million pounds per year to AviSun's capacity to produce this light, strong and versatile plastic—further stimulating acceptance and use by making it available in more abundant supply.

Bechtel worked with AviSun—jointly owned affiliate of American Viscose Corporation and Sun Oil Company—throughout every phase of the multimillion-dollar project, completing it ahead of schedule. Engineering was performed by AviSun and Bechtel, and Bechtel had sole responsibility for procurement and construction.

BECHTEL CORPORATION

Engineers and Builders for Industry

SAN FRANCISCO • Los Angeles • New York • Houston

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BECHTEL

To produce inerts in any quantity, for any job . . .

KEMP INERT GAS GENERATORS

—are best 3 ways!

1. Easy to start, set and forget

With Kemp's unique carburetor and external test burner, you check the pre-mixed gas-air ratio *before* it enters the combustion chamber . . . start fast with the electric ignition. Then set the vernial dial and forget it! The carburetor maintains the exact air-gas ratio—no rechecking needed.

2. Precise fuel control

You'll find the Kemp Carburetor automatically pre-mixes and keeps gas and air at the exact mixture you wish. And no matter what the total demand or pressure changes in your supply line, this precise air-gas ratio is maintained at all times.

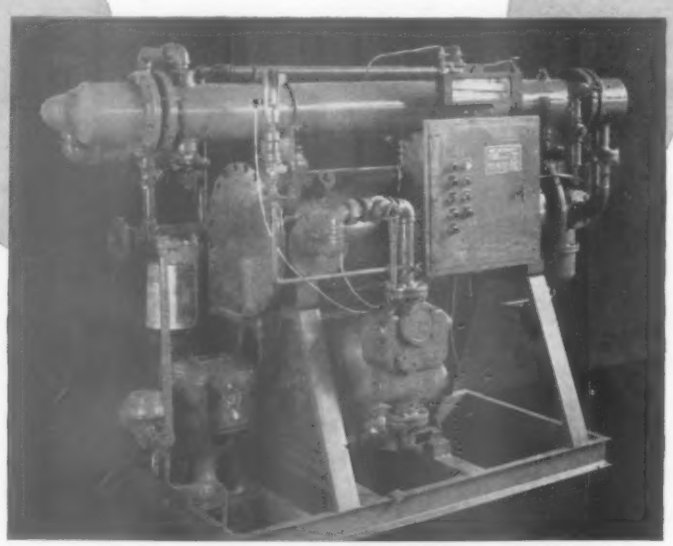
3. Automatic safety

Kemp safety controls eliminate the danger of flame-out. An electronic flame-failure control instantly, automatically cuts off the carburetor's gas supply. This control operates under all conditions . . . unaffected by moisture or combustion chamber pressure.

If you need inert gases for blanketing, purging and protective uses, write for Bulletin L-10 . . . or call in your Kemp Man listed in the yellow pages or the Chemical Engineering Catalog.

It always pays to come to

KEMP OF BALTIMORE



THE C. M. KEMP
MANUFACTURING COMPANY
405 E. Oliver Street • Baltimore 2, Maryland

Gas reforming hits a new high Engineering news was made in France recently, when a Chemico high-pressure gas reform furnace operating at 250 psi was placed on stream. Prior to the completion of this project, no gas reformer in the world had ever operated at pressures above 175 psi. Design innovations incorporated in this plant reduce compression requirements and increase heat recovery.

This historic breakthrough in gas reforming is indicative of the skill and experience which Chemico brings to all process engineering problems. Chemico services to clients in the process industries range from initial laboratory research and testing to final construction and start-up. If you are interested in learning more about Chemico, write to "Department B".

CHEMICO

CHEMICAL CONSTRUCTION CORPORATION

320 PARK AVENUE, NEW YORK 22, NEW YORK

CHICAGO/DALLAS/PORTLAND, ORE/TORONTO

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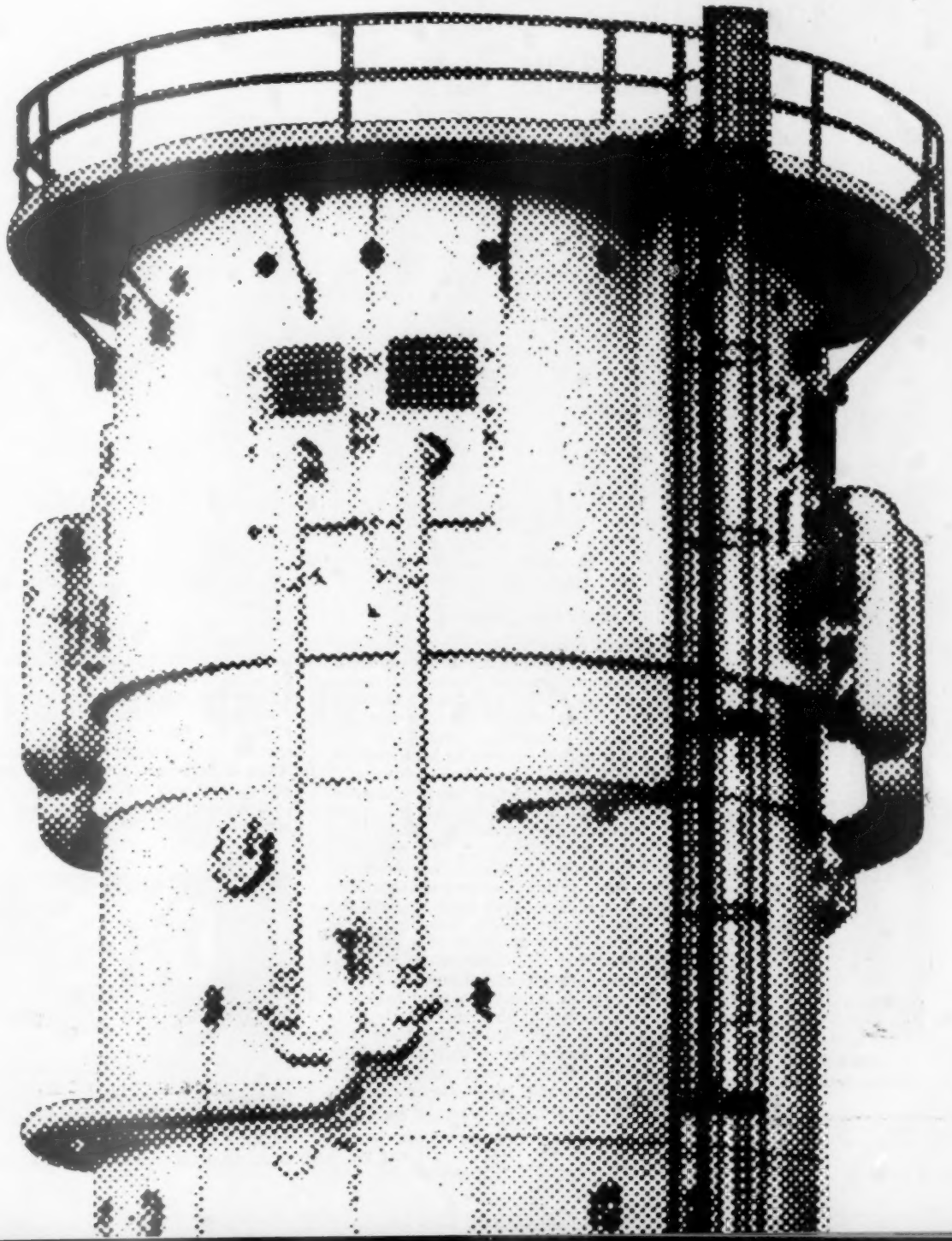


Better Production Tools Through Research

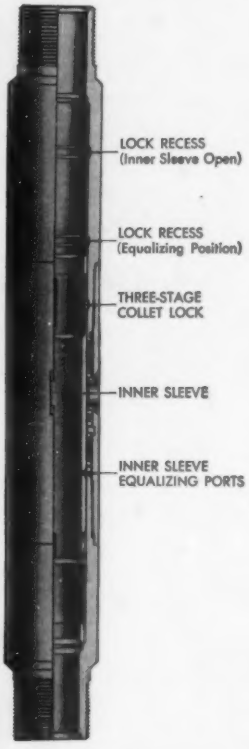
OTIS Equipment NEWS

Volume III, Number 1 **Otis Engineering Corporation • Dallas** *Production Equipment and Services*

Otis Sliding Side-Door Proves Most Versatile Circulating and Production Tool in the Field Today

Three Different Versions Solve Many Costly Production Problems

DALLAS — The Type A Otis Sliding Side-Door®, designed and introduced to the oil industry just four years ago, has become the most widely used selective circulating and production tool in the field today. Since its introduction, two modified versions — the Sliding Side-Door, with pump-out plugs and expendable shifting device, and the Sliding Side-Door Cross-Over — have been introduced.



TYPE A OTIS
SLIDING SIDE DOOR

© 1961 O.E.C.

The Type A Otis Sliding Side-Door is a full-opening tool designed to provide a selective means of establishing a flow course between the tubing and annulus without killing the well, moving the tubing or disturbing the packer setting. The tool is so designed as to permit any number of Sliding Side-Doors to be installed in a single string of tubing and any one or all opened or closed by wire line methods using a standard Otis Shifting Tool. When desired, the Type A Sliding Side-Door may be equipped with a special expendable shifting device and run into the well on the tubing in the opened position. This expendable shifting device serves to catch an aluminum ball or drop plug which is pumped down after circulating to close the sleeve.

Proven Design Features

According to the many operators using this equipment, there is an exclusive combination of features that makes the Otis Sliding Side-Door preferable for efficient well completion and economical production. These are: (1) Thoroughly proven in hundreds of wells. The design and mechanical operation of the tool has several years of operating proof behind it — the producer can use the Otis Sliding Side-Door with confidence. (2) Provisions for a positive indication that the sleeve is fully shifted. The standard Otis Wire Line Shifting Tool used to shift the sleeve of the Sliding Side-Door is designed to release itself only after the sleeve has been shifted to its fully opened or fully closed position. Equalizing ports in the sleeve serve to permit equalization of abnormal pressure differential while shifting the sleeve. (3) Outer sleeve design and construction combined with the clearance between the inner and outer sleeves serve to eliminate the metal-to-metal bind that makes shifting other tools often impossible. The Type A Otis Sliding Side-Door is designed to withstand the distorting forces of temperature, compression, tension or torque and still be shifted. (4) The flow area of the ports in the sleeve has proved ample for most applications.

Versions for Special Application

A Type A Otis Sliding Side-Door with pump out plugs and an expendable shifting device is also available which has been designed to cut completion costs and provide additional blow-out protection in that it serves to permit high differential drillable packers to be tested and the tree nippled up before unloading the well.

Another version is the Otis Sliding Side-Door Cross-Over which is designed to provide for complete zone isolation while changing or removing cross-over chokes in single-string, dual completions.

All three Otis Sliding Side-Doors are available in a wide range of sizes — and all three Sliding Side-Doors are good examples of the cooperation of Otis' Well Completion Specialists and Engineering Staff in assisting operators to meet today's demand for economical well completion and production tools. Literally thousands of production problems have been solved by Otis over the past thirty years. Perhaps you are faced with a production problem Otis could help solve. If so, call your local Otis specialist today. For more information on Otis Sliding Side-Door equipment, call the Otis office nearest you or write Otis, Dept. E-1, P. O. Box 35206, Dallas 35, Texas. You'll find experienced Otis Well Completion Specialists ready to help you . . . anxious to serve you . . . and with the widest variety of field proven production equipment and services available today.

OTIS
Engineering Corporation
General Offices:
8312 Harry Hines Drive • Dallas

PHOTO COURTESY OF SCHLUMBERGER

When the drill bites in, Cyanamid follows up!

These 5 product lines make drilling easier, safer, more profitable!

Cypan® Drilling Mud Additive – For filtration control and improved stability, this water soluble sodium polyacrylate mud additive is ideal. Cypan cuts costs, improves hole and mud stability, and is completely water soluble. Most effective in low pH muds.

Cemad® 1 Oil Well Cement Fluid-Loss Additive—An organic fluid-loss control agent designed specifically for use in oil well cements. Useful in both primary and squeeze cementing, Cemad 1 Additive has a minimum of retarder properties and is compatible with calcium chloride accelerators and many other cement additives.

AM-9* Chemical Grout—Applied as a water-thin, aqueous solution that sets in a controllable time into an impervious, rubbery mass. AM-9 is used by drillers as a faster and surer method for controlling water and sealing formations . . . such as sealing off water in air drilling, sealing water flood thief zones, and many other similar applications.

Aerosol® Surface Active Agents – used for foaming and cleaning out wells and pipelines.

Cyanamer® P-250 – a polymeric acrylamide used as a thickening agent.

For further information on the many Cyanamid products and their specific uses for the oil industry, see your Cyanamid technical representative or write the address below.

CYANAMID

*Trademark

American Cyanamid Company · Refinery Chemicals Department · Bound Brook, N. J.

3,500 H.P. converted to electric motors

providing dependable pipeline operation

at this modern outdoor station

all using utility electric power

In your gathering or mainline stations it will pay you to investigate the many advantages of converting to efficient and economical purchased electric power. Consult your nearest Utility Electric Power Company today!

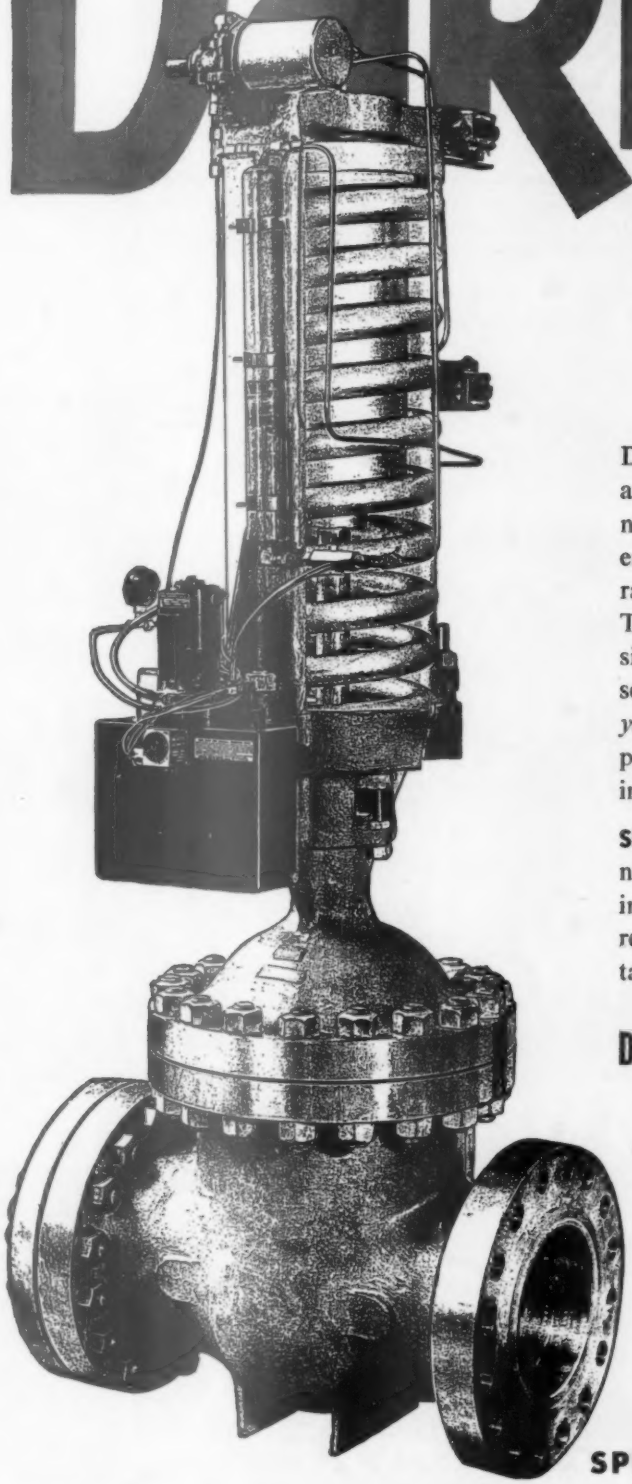
Petroleum Electric Power Association

P. O. Box 35006 • Dallas 35, Texas

List of P.E.P.A. members will be furnished on request.

YOU CAN DEPEND ON

Darling



Darling special stainless steel gate valves are meeting the most precise demands of nuclear services. They are used in power generation installations and for flow control of radioactive fluids.

These special-purpose valves have the exclusive benefit of our revolving double disc parallel seat wedge construction feature. That's why *you can depend on Darling* steel gate valves for positive sealing and continuous ease of opening and closing.

SPECIAL ENGINEERING SERVICE. Darling engineers are ready to work with you in designing special valves to meet unusual service requirements. Write, wire or phone for detailed information.

DARLING VALVE & MANUFACTURING CO.

Williamsport 1, Pa.

Sandilands Valve Manufacturing Company, Ltd., Galt 19, Ontario, Canada.
Vannes Darling-France, 23 rue du Commandant Mouchotte, St. Mandé, France.

TRADE DARLING MARK

GATE • BUTTERFLY • CHECK
SPECIAL VALVES • FIRE HYDRANTS

Pioneering New Oil Wells in the Laboratory...

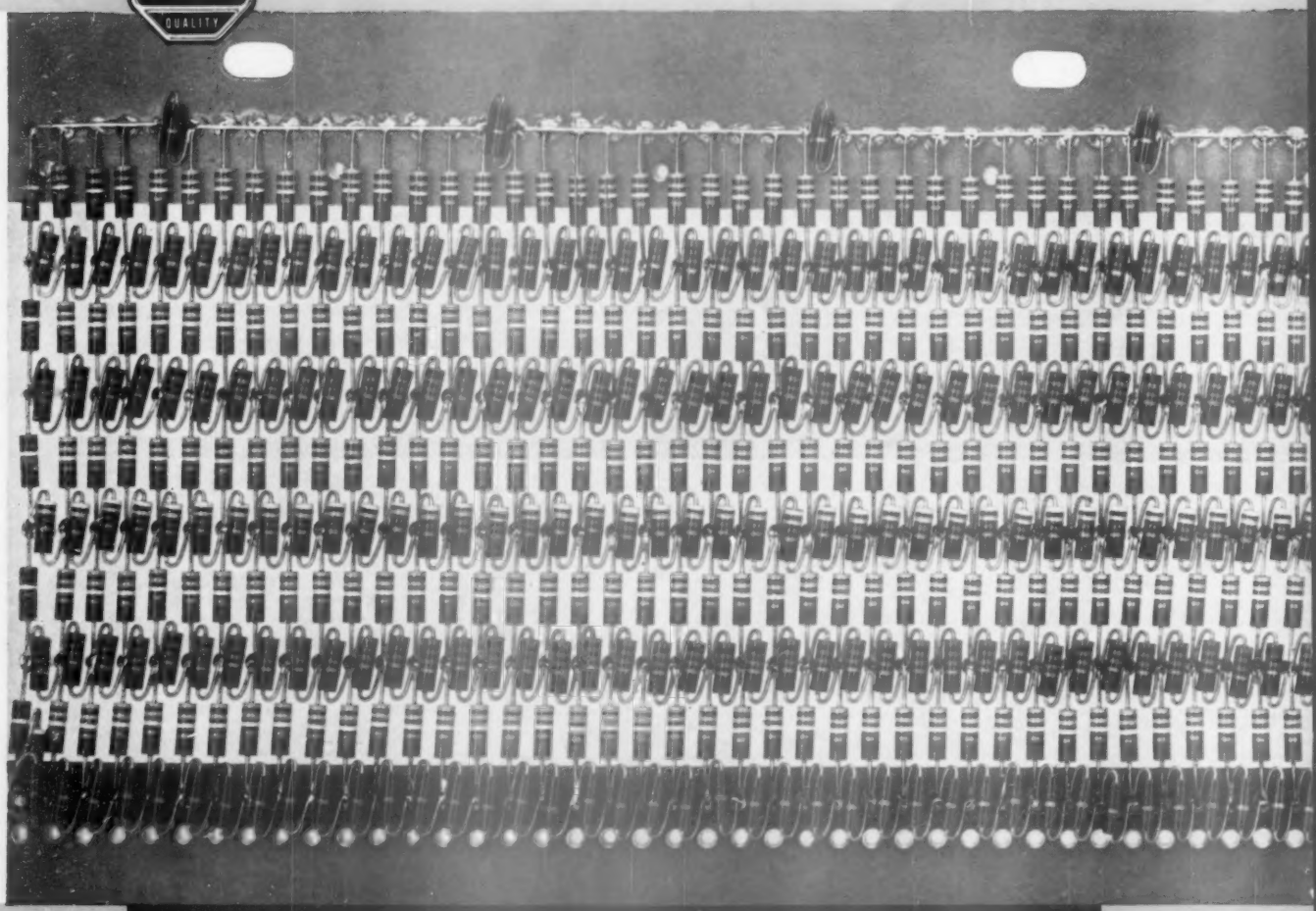
500,000 ALLEN-BRADLEY HOT MOLDED RESISTORS HELP MAP STRATA TO FIND "PRODUCERS"

This network of over 1,000 A-B hot molded resistors is one of hundreds of similar grids developed by the Schlumberger Well Surveying Corp. for studying ground strata to locate producing zones.

The unusually large number of resistors in use per unit makes reliability of paramount importance. Therefore, Allen-Bradley resistors —with their history of *complete freedom from catastrophic failure*—were a logical selection for this unusually critical project. The *exclusive* A-B hot molding process makes possible the amazing uniformity for which Allen-Bradley resistors are famous. To eliminate the probability of resistor failure in your equipment, Allen-Bradley resistors can be your only choice.

Allen-Bradley Co., 1304 S. Second Street, Milwaukee 4, Wis.
In Canada: Allen-Bradley Canada Ltd., Galt, Ontario

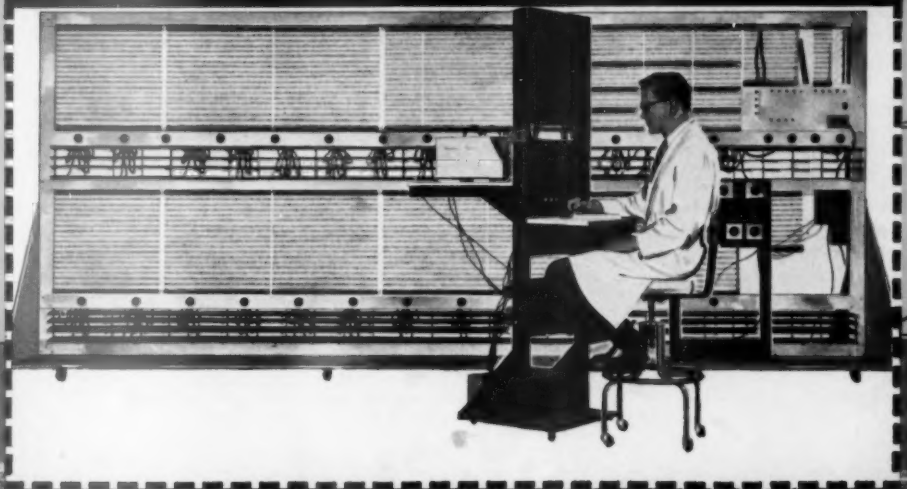
A-B QUALITY

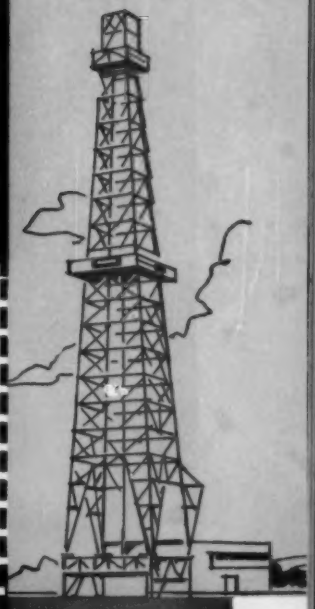


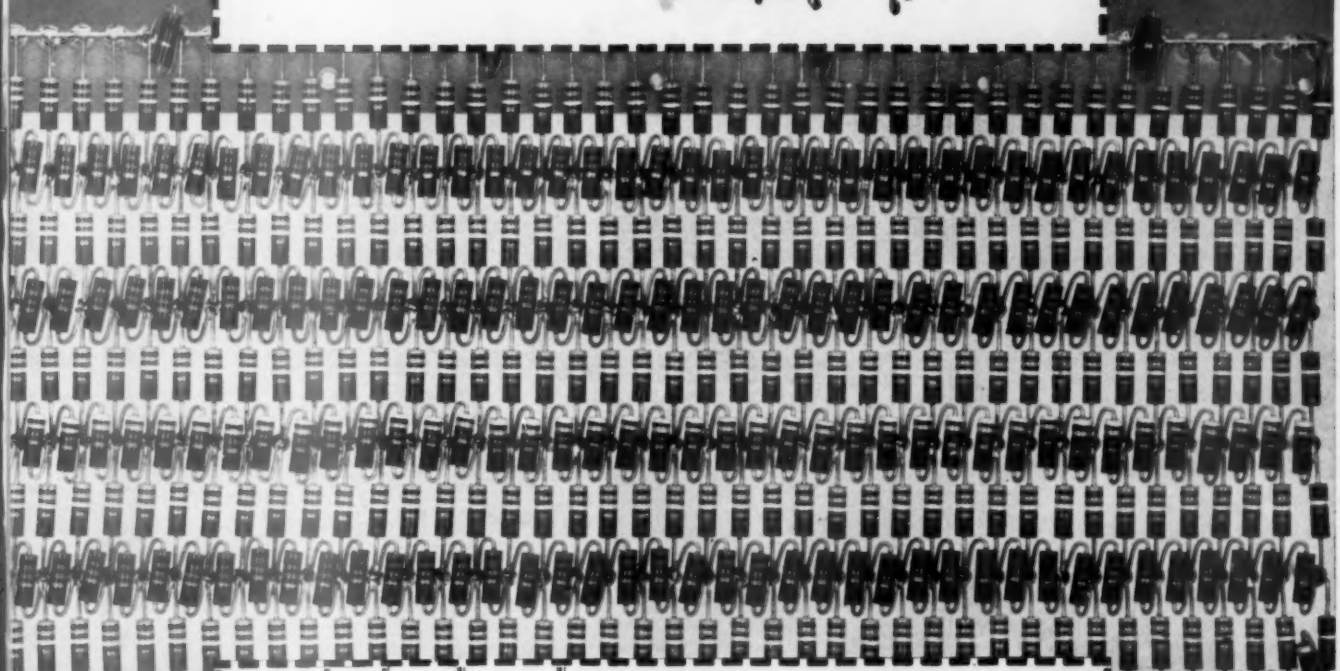
ALLEN-BRADLEY

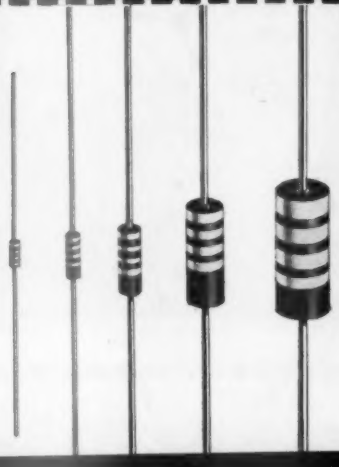
QUALITY ELECTRONIC COMPONENTS

This complex resistor network at Schlumberger's Research Center contains in its basic assembly some 150,000 of the 500,000 Allen-Bradley hot molded resistors which they have assembled into grids simulating earth formations. By inserting interchangeable grids into the network in various combinations, it is possible to simulate the borehole and formation parameters which affect resistivity measurements. Duplication of formation characteristics permits a more precise examination and interpretation of the different resistivity logs used in locating potential gas and oil producing zones.









ALLEN-BRADLEY HOT MOLDED RESISTORS are available in all standard EIA and MIL-R-11 resistance values and tolerances. Shown actual size from left to right:

Type TR 1/10 watt (MIL Type RC 06), Type CB 1/4 watt (MIL Type RC 07), Type EB 1/2 watt (MIL Type RC 20), Type GB 1 watt (MIL Type RC 32), Type HB 2 watts (MIL Type RC 42).

A-B also makes a quality line of hermetically sealed precision resistors. Using metal grid construction, they are noninductive. Ratings are 1/4, 1/2 and 1 watt at 125° C with tolerances of 0.1, 0.25, 0.5 and 1.0%; and TC ±25 PPM.

WAGNER® MOTORS AT WORK

power to pump petroleum

Special Wagner® oil well motors consume fewer kilowatts per barrel pumped

Positively. Yet they cost less to buy. For Wagner® DP-6 motors are engineered specifically for oil well pumping. They have electrical characteristics that permit "close motoring." Their high torque assures positive breakaway and acceleration for walking beam sucker-rod drives in any climate. Their high slip lets them slow down at peak load so the flywheel of the pump can deliver part of its stored energy to the load. As a result, these motors do consume fewer kilowatts per barrel pumped without sacrificing efficiency and dependability.

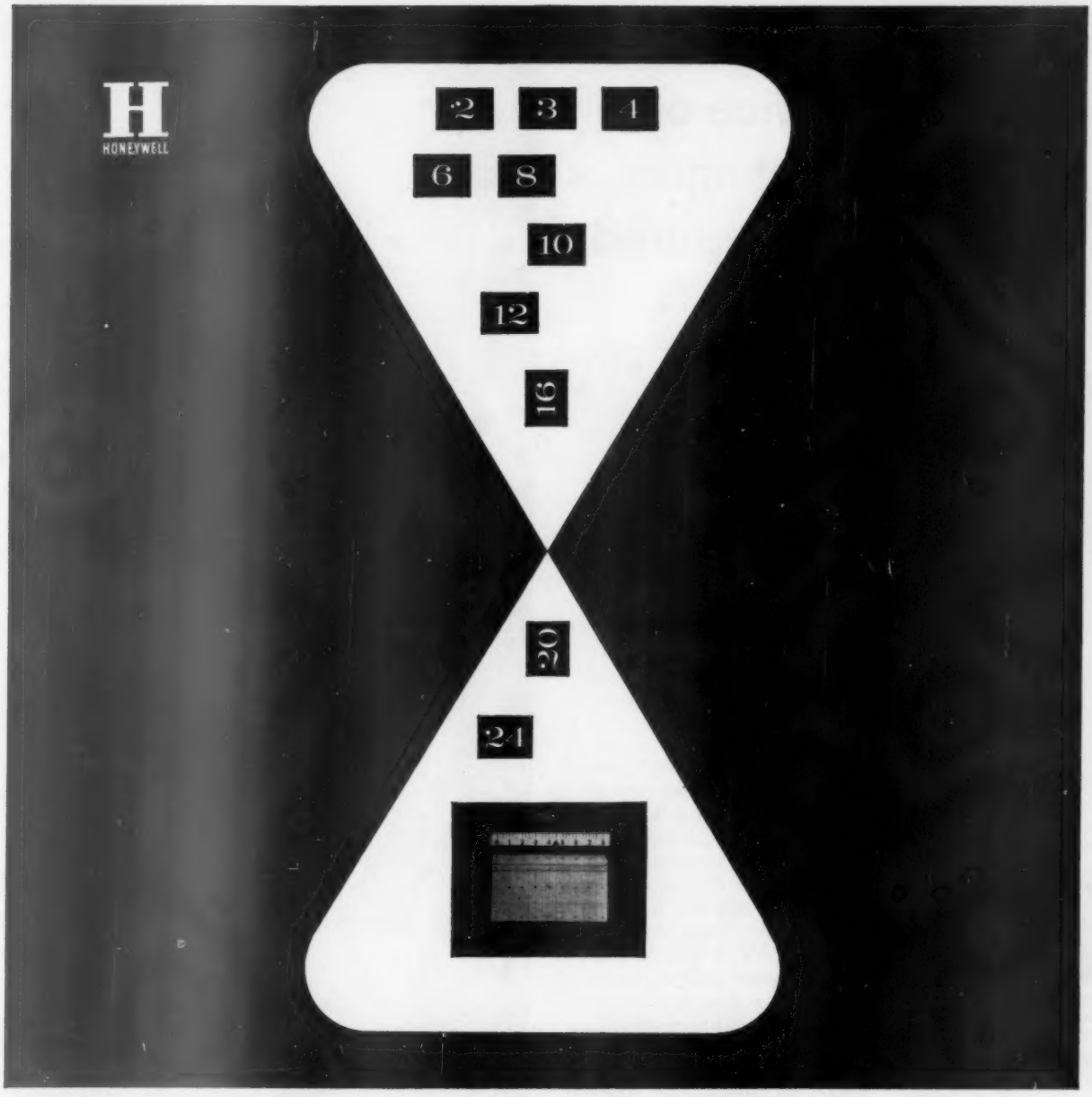
Particularly recommended for use in automatically controlled leases, Wagner DP-6 motors are built in 6-pole ratings of 3 through 75 hp. They are compact and drip-proof . . . protected against rain, sand, sleet and snow. Their rugged cast-iron frames and endplates bar corrosion . . . conduit boxes are moisture-proof and dust-tight. Ventilating openings are screened to keep out animals and wind-blown debris. Your Wagner Sales Engineer can show you how these motors, and specially designed pole type matching service transformers can provide even greater economies for your installations. Write for Bulletin MU-243 for full information.

Branches and Distributors in all Principal Cities

Wagner Electric Corporation

6389 PLYMOUTH AVENUE, ST. LOUIS 33, MISSOURI

WM61-2



RECORD 2 TO 24 POINTS with ten-in-one "quick-change" instrument

With the new Universal Multipoint ElectroniK 15 Recorder on the job, you'll be able to change the number of recording points from 2 to 3, 4, 6, 8, 10, 12, 16, 20, or 24 in a matter of seconds. With this "quick-change" feature built into it, the new Universal can do the job of 10 recorders!

Conversion is as easy as this—remove thumb nut and slip off old print wheel and indicator dial, slip on new wheel and dial, replace nut, plug in number of points desired and you're ready to go!

If the monitoring jobs in your laboratory, industrial shop, or industrial process require frequent changes in the number of records required, you'll want to get the complete story on the new Universal Multipoint ElectroniK 15 Recorder.

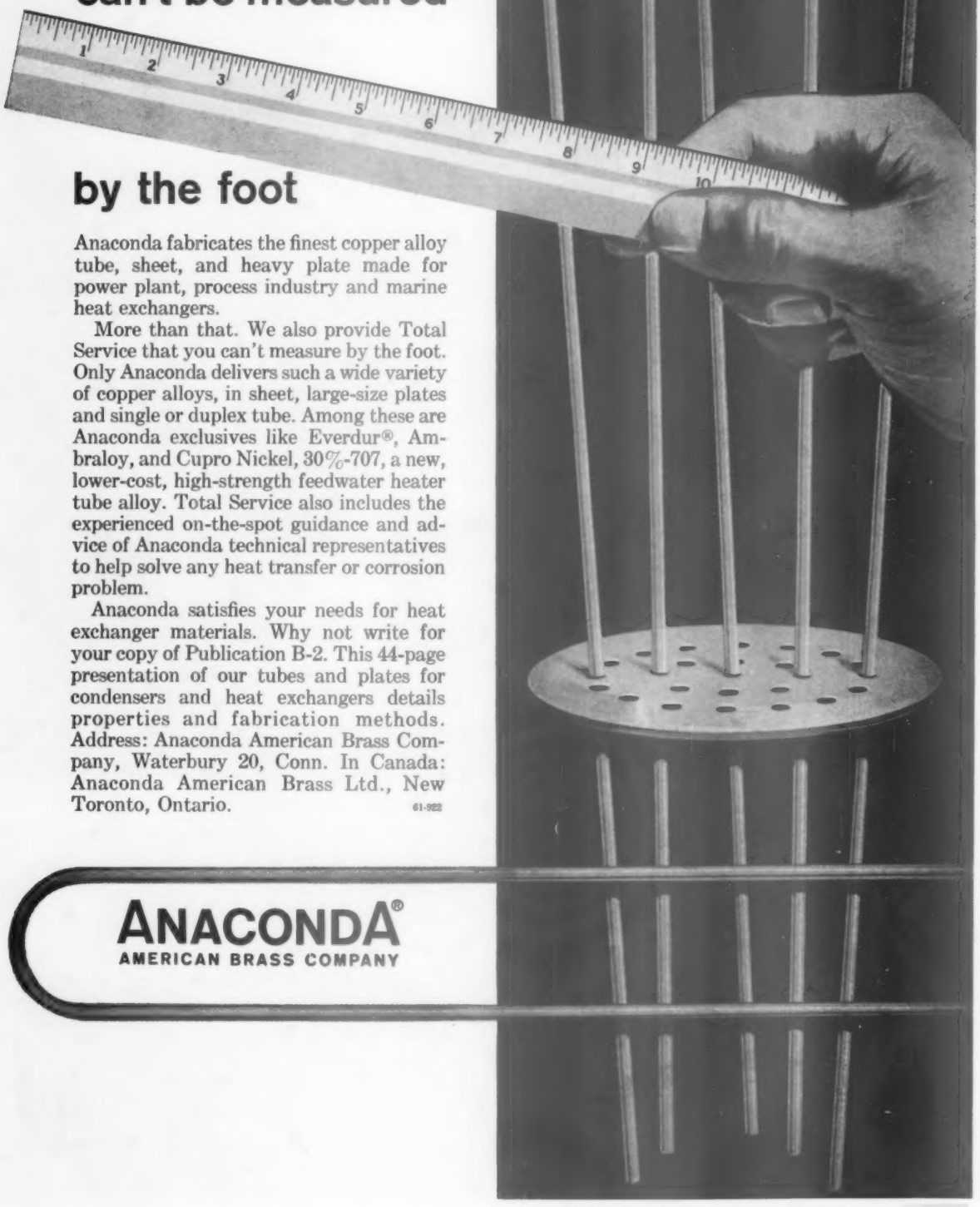
Contact your nearby Honeywell field engineer for full details. Minneapolis-Honeywell, Wayne and Windrim Aves., Phila. 44, Pa. In Canada, Honeywell Controls, Ltd., Toronto 17, Ontario.

Honeywell

H First in Control SINCE 1906

HONEYWELL INTERNATIONAL Sales and Service offices in principal cities of the world. Manufacturing in United States, United Kingdom, Canada, Netherlands, Germany, France, Japan.

Total Service on Heat Exchangers can't be measured



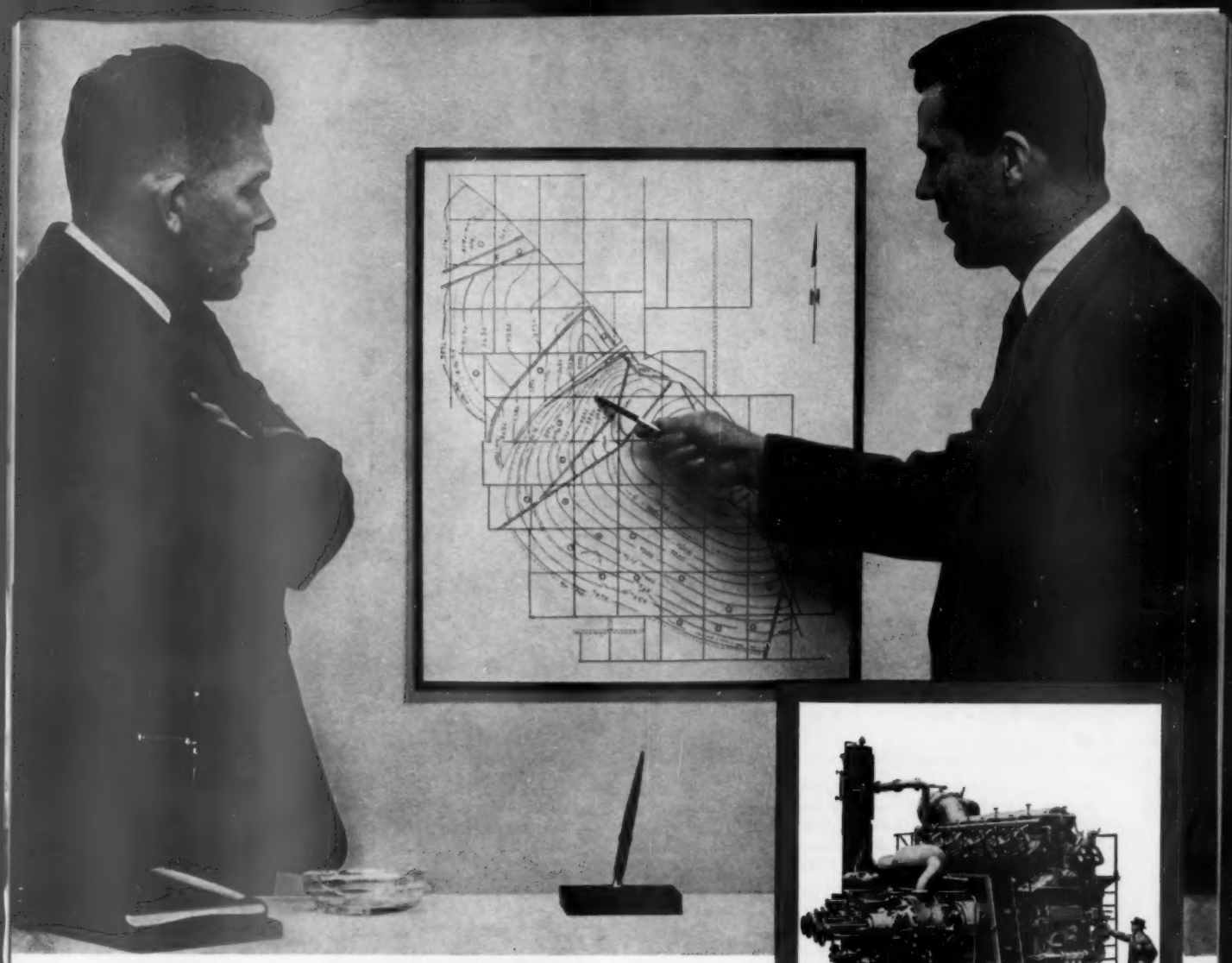
by the foot

Anaconda fabricates the finest copper alloy tube, sheet, and heavy plate made for power plant, process industry and marine heat exchangers.

More than that. We also provide Total Service that you can't measure by the foot. Only Anaconda delivers such a wide variety of copper alloys, in sheet, large-size plates and single or duplex tube. Among these are Anaconda exclusives like Everdur®, Ambraloy, and Cupro Nickel, 30%-707, a new, lower-cost, high-strength feedwater heater tube alloy. Total Service also includes the experienced on-the-spot guidance and advice of Anaconda technical representatives to help solve any heat transfer or corrosion problem.

Anaconda satisfies your needs for heat exchanger materials. Why not write for your copy of Publication B-2. This 44-page presentation of our tubes and plates for condensers and heat exchangers details properties and fabrication methods. Address: Anaconda American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario. 61-922

ANACONDA®
AMERICAN BRASS COMPANY

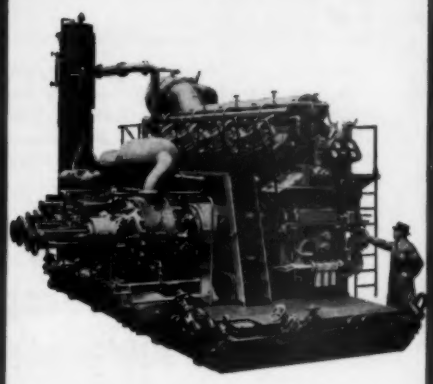


From Attic Oil to Retrograde Condensation . . .

C-B/S Compressor Plant Designs Solve Your Problems in Gas Injection

To build a compressor plant, whether it's 100 bhp or 1,440 bhp, to operate with economic efficiency in a gas injection system, the manufacturer must be able to recognize and understand your problem. C-B/Southern builds compressor plants which meet the complex requirements of artificial recovery such as pressure maintenance, cycling, and other secondary recovery operations. Here is experience drawn from building more than 40,000 compressor horsepower last year, much of it for gas injection systems, and the years C-B/S people have spent as oil and gas engineers. That is why C-B/S knows how to design and build the compressor unit that works most economically and most efficiently with your gas injection system.

And remember: C-B/S compressors are available in sizes from 100 to 10,500 horsepower.



This 1,440 horsepower plant is capable of handling more than 6½ MMCFD with injection pressures up to 5,000 psi. It is now in use in a major producing area.

CB/S

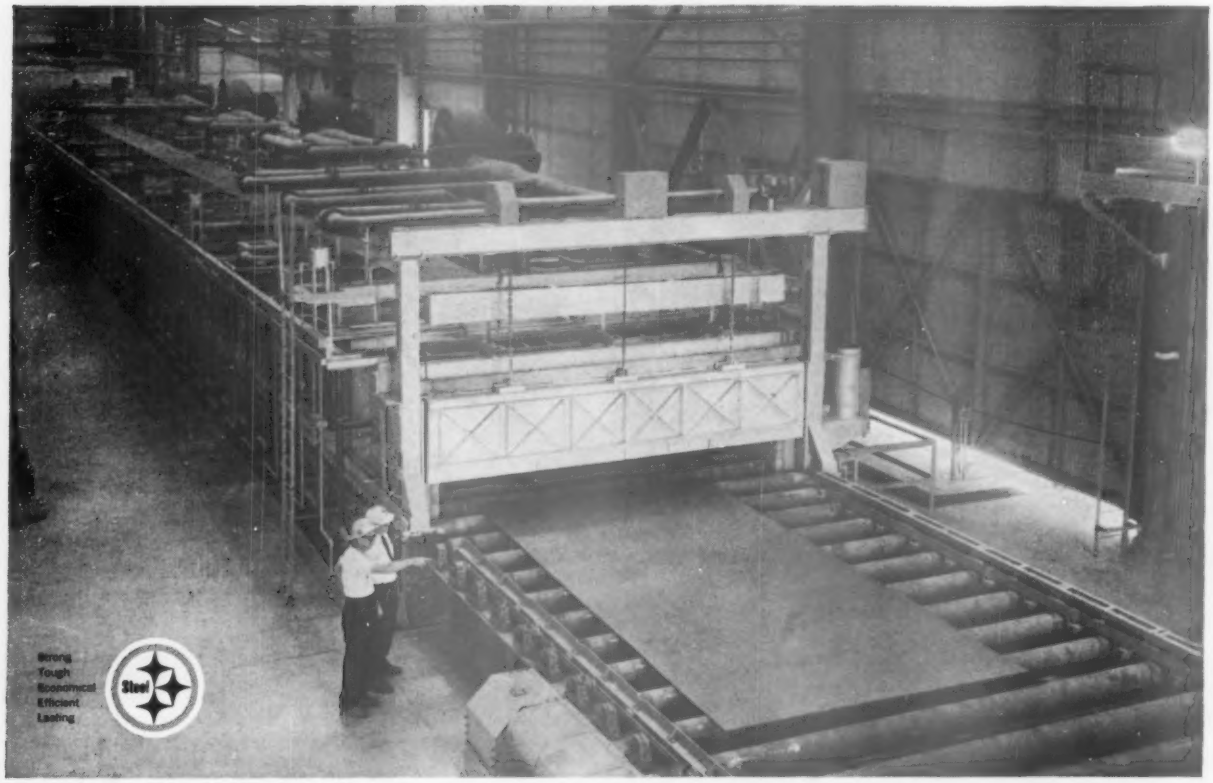
PACKAGED COMPRESSORS

CB/S

C-B/SOUTHERN, P. O. BOX 19267, HOUSTON 24, TEXAS, HOmestead 8-5441

A division of The Cooper-Bessemer Corporation

MANUFACTURERS OF PACKAGED COMPRESSOR PLANTS FOR GAS GATHERING, GAS LIFT, GAS INJECTION APPLICATIONS



Completion of this new heat-treating line in Sheffield's Houston plant marks a new era for industry served by Sheffield from the Southwest. The new line shown has the capacity to heat-treat all gauges and sizes of plates rolled on the plant's plate finishing mills. It produces quenched and tempered or normalized plates. It is also designed to handle the wider and heavier plates which will be rolled in the Houston plant's new 160-inch combination slab and plate mill—to be completed in 1962.

Sheffield now makes available a complete line of alloy steels

New heat treating facilities now in operation

This is one of the most modern heat treating lines in the country. With this addition, Sheffield's facilities are now complete for processing all types of alloy steel including new SSS-100. This is the remarkable new Sheffield alloy steel which makes it possible to design with lighter components without sacrificing strength. For more information write **Sheffield Division, Armco Steel Corporation, Attention Alloy Sales, P.O. Box 3129, Houston 1, Texas.**

SHEFFIELD
Heat Treated Carbon and Alloy Steels

The ultra-modern group of electronic devices you see above regulates temperature, pressure and timing in Sheffield furnaces automatically. Plates are quenched in water, then re-heated in the tempering furnace. An operator checks the entire process by closed-circuit television which can "see" the inside of the furnaces.

ARMCO Sheffield Division

THE GROVE FLEXFLO® REGULATOR IN THE LINE 5 YEARS WITHOUT SERVICE

Handling flow rates from 3 to 5 MMSCF/hr 300 psig to 380 psig inlet, 53 to 55 psig outlet pressures

This 8" model 80-820 Flexflo has been under the above service without maintenance for over 5 years at Pacific Gas and Electric Company's Moss Landing plant. A similar "standby" unit has never been uncrated. There are many case-proven examples of the reliability, dependability and maintenance-free service of Grove Flexflo pressure reducing and relief regulators. Such service, plus the amazing simplicity and versatility of Flexflos, makes them worthy of your consideration. For complete technical presentation, write for Bulletin 800.

GROVE REGULATORS

GROVE VALVE AND REGULATOR COMPANY

A subsidiary of Walworth

6529 HOLLIS STREET • OAKLAND 8, CALIFORNIA

Offices throughout the U.S. and in Western Canada

7339

ORBIT FORGED STEEL VALVES
FOR GENERAL PRODUCTION USE

PATENT APPLIED FOR

Sectional view of Orbit's Type "N" seat shows how we securely contain Teflon to prevent loss of material or cold flow and how a Teflon to metal seal is provided.

Body Seat Ring—Teflon with Metal-to-Metal Back-Up Seating.

ORBIT VALVES COMBINE 3 THREE PROVEN SEATING PRINCIPLES IN 1 ONE VALVE SEAT

The ORBIT Valve seating principle is best described as employing: (1) Globe valve seating, (2) Wedge valve action, (3) Plug valve rotation — all three principles are combined to provide Friction-Free seating plus Full Round Straight thru flow, and to eliminate normal valve wear problems, and to provide long valve life, yet no lubrication is required for a shut-off. Valve replacement problems are minimized.

The body seat is designed with a convex seating surface formed by the Teflon and metal — this provides for absolute shut-off and assures positive closure under severe conditions. The Teflon is so contained that it is not affected by high differential pressures flowing across the seat. Normal manufacturing tolerances as well as normal valve wear are compensated for by the resilient Teflon material.

ORBIT TYPE "N" BODY SEAT WITH MOLDED TEFLON* FEP RESIN PROVIDES:

(1) resilient seating with metal-to-metal back-up.

(2) friction-free seating.

(3) seating without lubrication.

*Teflon is duPont's registered trademark for its family of fluorocarbon resins, including FEP resin.

ORBIT VALVE COMPANY
P. O. Box 699 Tulsa, Oklahoma
Phone LUther 4-4761 TWX TU 925

ORBIT VALVES

FOR ADDITIONAL INFORMATION WRITE FOR BULLETIN No. 400

SPENDING DAYS TO SAVE WEEKS

When a National Supply drilling rig customer orders a "rig-up," he spends a few days — that can be spared — to save weeks that would be far more expensive to lose.

In a "rig-up," all components of a drilling rig — engines, pumps, drawworks, rotaries, etc. — are completely assembled at the Houston plant before shipment. The rig is then test-operated to make sure everything is in order.

Parts can be color-coded, so their place in the final assembly is immediately apparent. Erection, even at some far-away spot, is thus simplified and speeded. Difficulties and delays are virtually eliminated.

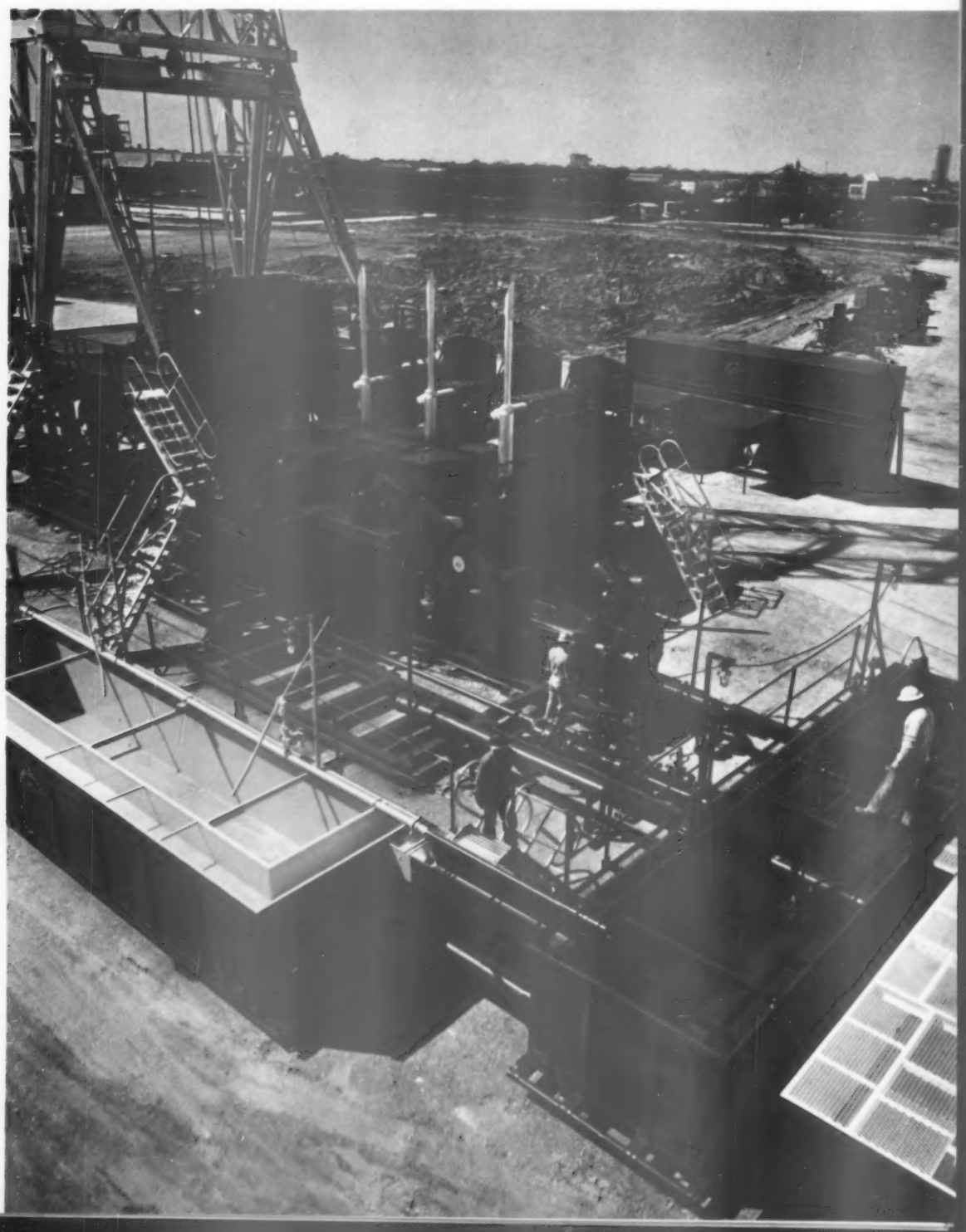
Customers using these National test-assembled rigs report *faster rig-up time than previous field assemblies.* For either domestic or overseas operations, it can be the best insurance you ever bought. Ask your representative for details, or write to National Supply Division, Armco Steel Corporation, Two Gateway Center, Pittsburgh 22, Pa.

On next pages:
National Supply rigs

FOUR SOUND, ECONOMIC REASONS WHY

A RIG FOR EVERY NEED. National's complete line of thirteen rigs serves every hoisting and drilling requirement — from shallow wells, to the world's deepest wells, including well servicing and workover. If mobility is a problem, we can furnish truck or trailer mounted rigs, helicopter rigs, rigs packaged into easily airborne units.

EXTRA ENGINEERING. There are no compromises in the design or materials of National rigs. In fact, each one has extra built-in stamina that many National rig users call the "driller's margin." This margin accounts for important performance differences on every well.



NATIONAL RIGS ARE INVARIABLY FIRST CHOICE

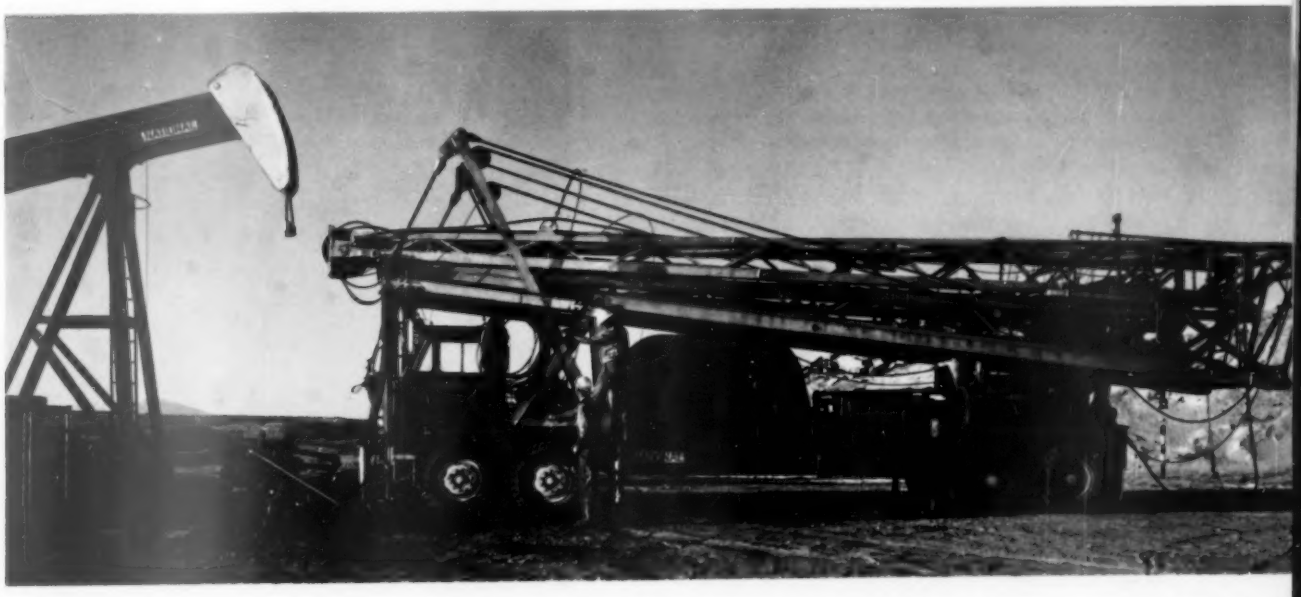
OPTIONAL RIG-UP SERVICE. Before a rig is shipped, it is completely assembled and test-operated, lubricated and adjusted. Related units can be color-coded for fast, simple assembly. If additional companion equipment or services are required, they are furnished immediately.

WORLD-WIDE SUPPLY SERVICE NETWORK. National Supply rigs are now operating around the world. And National Supply has the facilities and representatives around the world to furnish complete, economical technical assistance when needed. This service is one reason why National Supply is the world's largest supplier of oil country equipment.

A National Supply representative will be happy to point out the advantages of each of these rigs, or you can get details by writing to National Supply Division, Armco Steel Corporation, Two Gateway Center, Pittsburgh 22, Pa.

NATIONAL DRILLING RIGS

TYPE	INPUT HORSEPOWER RATING	DEPTH RATING (NOMINAL FT.)
T-12	200	1,500 to 3,000
T-20	300	2,000 to 4,000
T-32	400	3,000 to 5,500
T-45	550	4,500 to 7,500
55	700	6,000 to 9,000
80-B	1,000	8,000 to 12,000
110	1,375	11,000 to 16,000
130	1,625	13,000 to 20,000
Helicopter		
4-10	600 to 1,000	5,000 to 10,000
Drive-in Units		
200	150 to 250	
300	250 to 350	
Diesel-Electric Drawworks		
1320-DE	1,625	13,000 to 20,000
1625-DE	2,500	16,000 to 25,000



This National Model 300 Drive-in rig is pulling into a remote location in Colorado for workover service. Both National Supply self-propelled Drive-in rigs, the Model 200 and the Model 300, are carefully engineered for every oil country job from rod and tubing servicing to deep workover.

This Type 55 rig is ready for shipment to Iran after test rig-up at National's Houston plant. This rig has a National drive group with three Superior engines and National torque converters, and a National K-700 slush pump with a National dampener.

Steel

Steel's Symbol of strength, long life, and economy

NEW NATIONAL MICROMATIC DRILLING CONTROL CAN LOWER DRILLING COSTS

National's new Model #6 Drilling Control is a rugged, dependable device that automatically operates the drawworks just as the most experienced driller does, and insures the exact penetration rate desired. Usable on almost every new and old drawworks, the Micromatic feeds off the drilling string smoothly and continuously, with maximum safety. Unit is compact, easy to install. Installation time is about six hours and can be done on location.

With the National Micromatic, the drilling string is under complete control at all times; weight on the bit can be increased or decreased at will; and the control can be engaged or disengaged in minutes.

The driller first obtains the desired amount of weight on the bit; snaps and locks the control connecting rod to the brake lever and then opens two air valves in the control cabinet. The Micromatic takes over and maintains the desired weight on the bit.

Ask a National Supply representative to point out how the Micromatic can speed your drilling operations. Or write to National Supply Division, Armco Steel Corporation, Two Gateway Center, Pittsburgh 22, Pennsylvania.

Micromatic controls are within easy reach of the driller and can be engaged or disengaged in a matter of moments. Controls are circled in red on illustration at right.

ARMCO National Supply Division

Business Barometer:

H_2SO_4

Mathieson Sulfuric Acid

The demand for sulfuric acid is as much a barometer of business as Gross National Product. That's why dependable supply is so important to you. So is expert, careful economic analysis relating all factors of cost to your own location and requirements. Mathieson can be depended upon for both. Our major production facilities are backed by major transportation facilities and strategically located shipping points – all designed and planned to deliver commercial grades of H_2SO_4 fast.

Add expert help in spent acid recovery, complete safety and handling instructions and technical assistance when and where you need it, and you can readily appreciate the benefits derived from ordering your sulfuric acid from Mathieson. The extensive experience of your Olin Mathieson man and our laboratory facilities are at your disposal. Write or call us today: OLIN MATHIESON, Baltimore 3, Maryland.

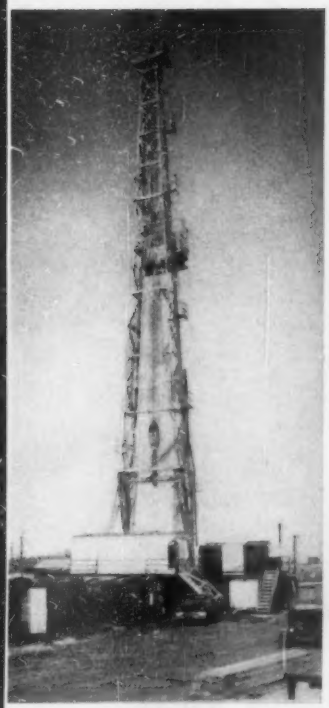
SULFURIC ACID SHIPPING POINTS: Baltimore, Md. • Little Rock, Ark. • Bossier City, La. • Joliet, Ill. • Beaumont, Port Arthur, Pasadena, Tex.

Ammonia • Carbon Dioxide • Caustic Soda • Chlorine • Hydrazine and Derivatives • Hypochlorite Products • Methanol • Muriatic Acid • Nitric Acid • Soda Ash • Sodium Bicarbonate • Sodium Chlorate • Sodium Chlorite Products • Sodium Methylate • Sodium Nitrate • Sulfur (Processed) • Sulfuric Acid • Urea

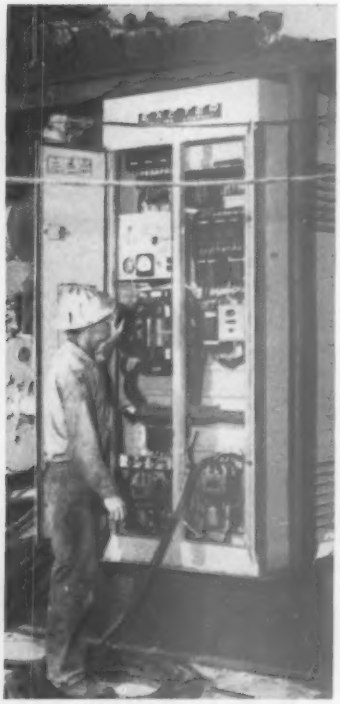
241

Olin

CHEMICALS DIVISION



CASCADE—First diesel-electric drilling rig operating in Canada.



EXETER—First dual power generator assignment providing variable-constant engine speed control.

SLATS HONEYMON—First dual power output with independent speed control for mud pump and rotary.

HELMERICH & PAYNE First 2-speed draw works; driven by gear motors.

DIXIE—First electric drilling rig package for rotary table operation only.

CALDRILL—First diesel-electric powered drilling rig operating on an offshore California platform.

Progressive Contractors

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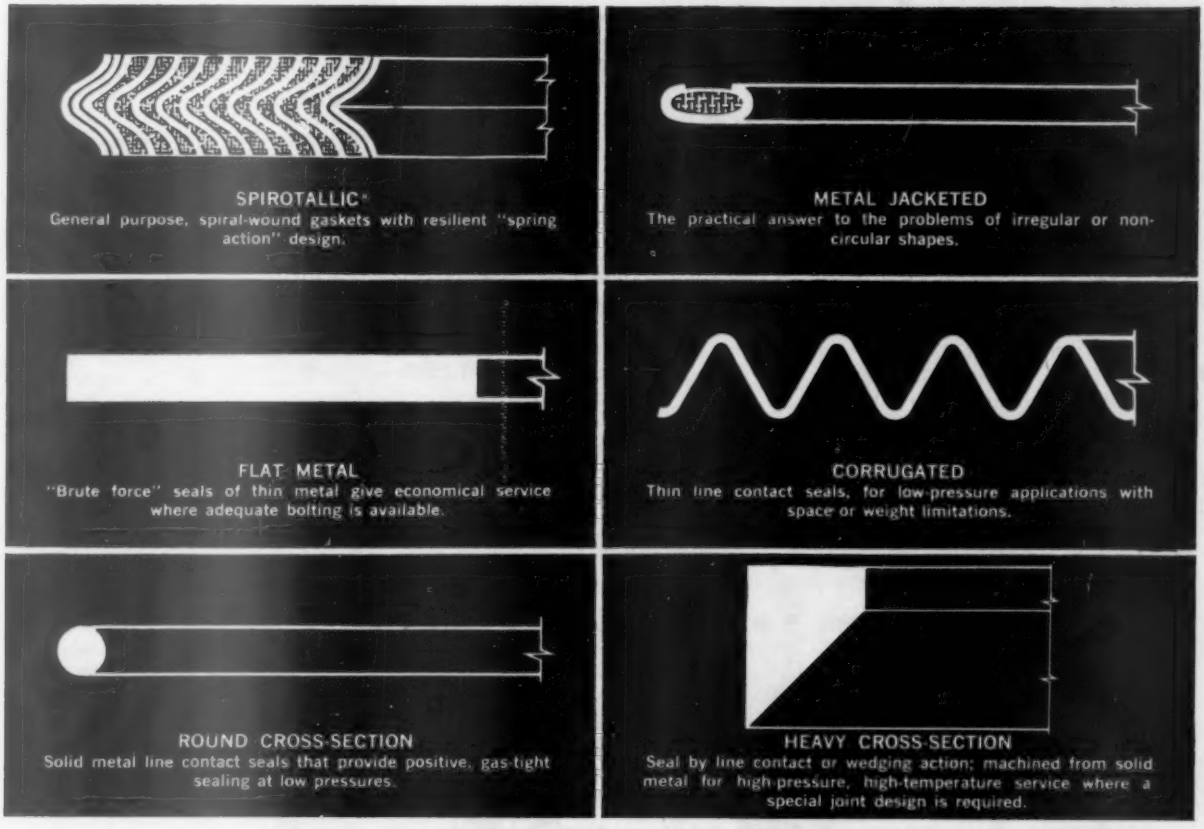

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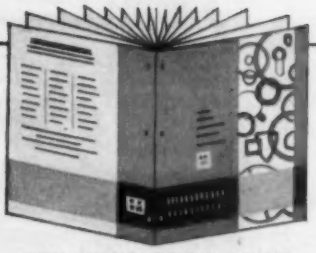

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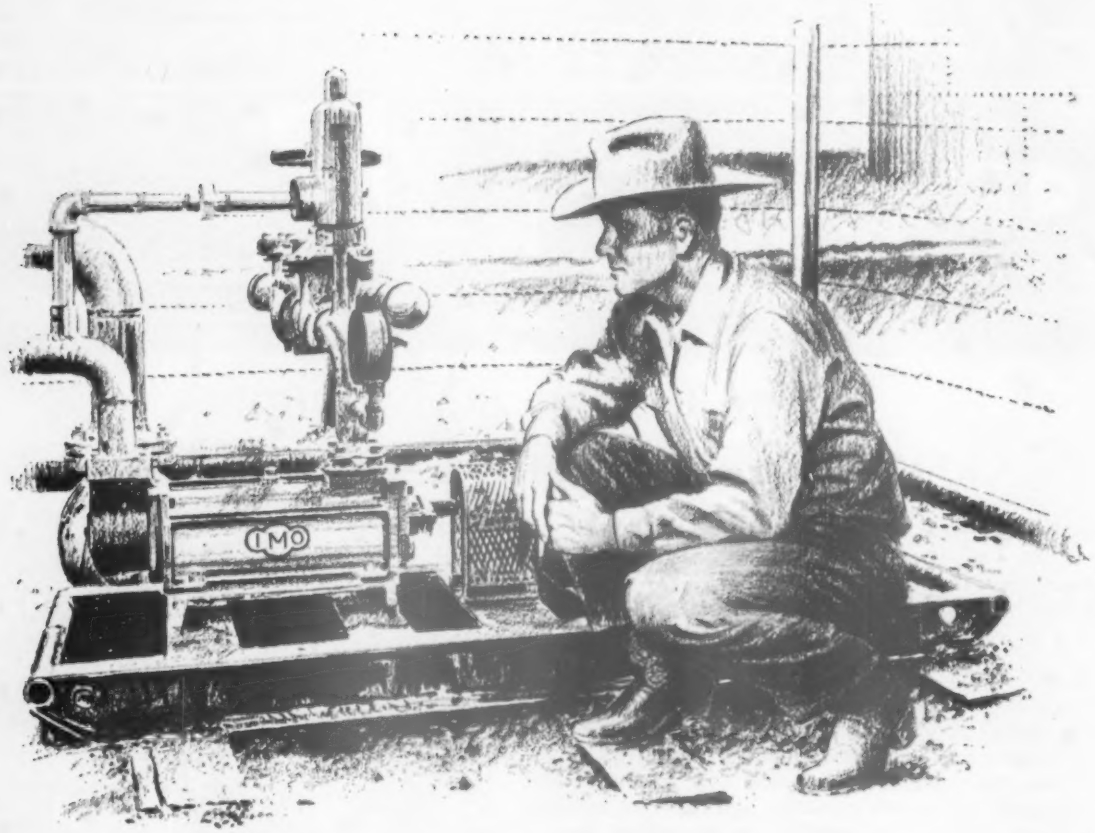

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THEY SAY

Any school boy should know

Dear Sir:

The Journal is doing a wonderful job and should please oil men everywhere. I hope you will continue the editorials lambasting the management of the gasoline makers who are destroying the oil industry.

Any school boy should know better than to manufacture more than demand calls for.

C. M. Powell
Powell Drilling Co.
Fort Worth

Special section made a hit

Dear Sir:

I have just read with a great deal of interest your article on refinery instrumentation and control in the October 23 issue of The Oil and Gas Journal (p. 105).

The section on the use of digital computers for control of refinery process was of special interest . . . the section on process stream analyzers had much valuable information. . . .

Congratulations on the excellent article.

G. S. McMahon
Manager Technical Services
Cit-Con Oil Corp.
Lake Charles, La.

Remember back in '07 . . .

Dear Sir:

I must take exception to your note on p. 194 on the October 23 issue. The Cities Service No. 1 Grassy Trail well in Utah is not the first Moenkopi oil production in the state. The Virgin oil field, discovered in 1907, has produced around 200,000 bbl. from limestones near the base of the Moenkopi.

Ed Heylmun
Salt Lake City

Our faces are red, and our correlators have been changed—Ed.

Marketers' continual quest

Dear Sir:

Your editorial in the November 6 issue entitled "Two dozen men could lift oil from chaos" (p. 65) was a masterpiece in that it cut to

the heart for a solution to our present oil industry woes.

As an independent oil producer also having wholesale marketing interests, it is my thinking that most of our troubles are caused by major companies in their never-ending quest for more marketing outlets for their excessive refinery runs.

When their own outlets are filled, excess stocks end up on the spot market at a lower price. Marketing interests that buy at distress prices and, of course, sell at cut-rate prices, may be independents, as the majors maintain, but it is pretty clear how the mess originated.

Proration is geared to the refiners' anticipated demand. Producers of crude sell only what the pipelines and refiners will buy. It is obvious what happens when refined stocks are out of balance with demand for a long time. Pressure is put on the crude-price structure.

I am a stockholder of a major integrated oil company. The top management of this company and other major companies has an obligation to do some forward thinking about the present and future well-being of our industry.

Elmer J. Clawson
Clawson Oil Co.
Hartford, Kans.

Letters to They Say should be addressed to The Editor, The Oil and Gas Journal, Box 1260, Tulsa, Okla.

CALENDAR

NOVEMBER

27-Dec. 1 National Association of Corrosion Engineers, southeast region conference and Florida general conference short course, Key Biscayne Hotel, Miami.

30-Dec. 1 Mid-Continent Oil and Gas Association, annual advalorem tax forum, Baker Hotel, Dallas.

DECEMBER

3-6 American Institute of Chemical Engineers, annual meeting, New Yorker Hotel, New York City.

4 AIME's Society of Petroleum Engineers, Arizona section, annual meeting, Pioneer Hotel, Tucson.

4-6 Interstate Oil Compact Commission, annual meeting, Denver Hilton Hotel, Denver.

5-6 National Petroleum Refiners, Association, computer conference for refiners, Hotel Tulsa, Tulsa.

JANUARY

7-10 Pipe Line Contractors Association, annual convention, Boca Raton Hotel and Club, Boca Raton, Fla.

8-12 Society of Automotive Engineers, annual meeting, Cobo Hall, Detroit.

16-18 Kentucky Petroleum Marketers Association, annual meeting, and convention, Brown Hotel, Louisville, Ky.

17-19 National Association of Corrosion Engineers, Canadian region eastern division conference, King Edward Hotel, Toronto.

19 Natural Gas Processors Association, Gulf Coast regional meeting, Robert Driscoll Hotel, Corpus Christi, Tex.

24-26 American Society of Mechanical Engineers, second symposium on thermophysical properties, Princeton University, Princeton, N. J.

31-Feb. 1 National Petroleum Refiners Association, Gulf Coast regional meeting, Ben Milam Hotel, Houston.

FEBRUARY

4-7 American Institute of Chemical Engineers, national meeting, Statler Hotel, Los Angeles.

12-13 Missouri Oil Jobbers Association annual convention and trade exhibit, Hotel Chase, St. Louis.

14-16 Southwestern Legal Foundation, annual institute on the law of oil, gas, and taxation, Southwestern Legal Center, Dallas.

14-17 Pipe Line Contractors Association of Canada, Castle Harbor Hotel, Bermuda.

16 Natural Gas Processors Association, South Louisiana regional meeting, Lafayette Petroleum Club, Lafayette.

18-22 American Institute of Mining, Metallurgical, and Petroleum Engineers, annual meeting, New York City.

22 Chemical Institute of Canada, protective coatings division, Seaway Hotel, Toronto.

23 Chemical Institute of Canada, protective coatings division, Windsor Hotel, Montreal.

28-Mar. 2 American Petroleum Institute, Division of Production, southern district meeting, Rice Hotel, Houston.

MARCH

1-2 Southwestern Legal Foundation, conference on economics of gas industry, Southwestern Legal Center, Dallas.

2 Ohio Oil and Gas Association, winter meeting, Deshler Hilton Hotel, Columbus, Ohio.

4-8 American Society of Mechanical Engineers, gas turbine-process industries conference, Shamrock Hilton Hotel, Houston.

6-7 National Petroleum Refiners Association, eastern regional meeting, Sheraton-Cleveland Hotel, Cleveland.

13-15 Symposium on Application of Statistics and Computers to Fuels and Lubricants Research Programs, sponsored by research branch, office of the chief of ordnance, Department of the Army, Granada Hotel, San Antonio.

15-16 Society of Petroleum Engineers of AIME, economics and valuation symposium, Dallas.

16 Natural Gas Processors Association, Oklahoma regional meeting, Sheraton-Oklahoma Hotel, Oklahoma City.

19-22 Kentucky Petroleum Marketers Association, management institute conducted by the University of Louisville, Brown Hotel, Louisville, Ky.

21-23 New England Gas Association, annual meeting, Statler-Hilton Hotel, Boston.

21-23 American Petroleum Institute, Division of Production, southwestern district meeting, Lincoln Hotel, Odessa, Tex.

26-29 American Association of Petroleum Geologists, Society of Economic Paleontologists and Mineralogists, joint annual meeting, Fairmont Hotel, Civic Auditorium, San Francisco.

27-29 American Society of Mechanical Engineers, power conference, Sherman Hotel, Chicago.

APRIL

2-4 National Petroleum Refiners Association, annual meeting, Granada Hotel, San Antonio.

3 Chemical Institute of Canada, chemical economics division conference, Royal York Hotel, Toronto.

4-6 API, Division of Production, Mid-Continent district meeting, Sheraton Oklahoma Hotel, Oklahoma City.

5-6 Society of Petroleum Engineers of AIME, upper Gulf Coast region, drilling and production practices conference, Beaumont, Tex.

9-10 Instrument Society of America, national chemical and petroleum instrumentation symposium, Wilmington, Del.

9-11 Mid-West Gas Association, annual meeting, Hotel Radisson, Minneapolis.

9-12 National Oil Fuel Institute, national oil heat and air conditioning exposition, Chicago.

11-12 Petroleum Industry Electrical Association and Petroleum Electric Supply Association, convention and exposition, Dallas.

11-13 API, Division of Production, Rocky Mountain district meeting, Hilton Hotel, Denver.

12-13 Society of Petroleum Engineers of AIME, new petroleum production and reservoir engineering developments, Mayo Hotel, Tulsa.

14-18 Petroleum Equipment Suppliers Association, annual meeting, Boca Raton Hotel, Boca Raton, Fla.

15-18 American Society of Mechanical Engineers, oil and gas power division conference, Shoreham Hotel, Washington.

17 Society of Plastics Engineers, Philadelphia section, regional technical conference, Sheraton Hotel, Philadelphia.

17-19 Southwestern Gas Measurement Short Course, University of Oklahoma, Norman.

17-19 American Society for Metals, regional conference and exhibition, materials and materials processing for the petroleum, petrochemical and chemical industries, Shamrock-Hilton Hotel, Houston.

23-25 American Association of Petroleum Geologists, Rocky Mountain section annual meeting, Salt Lake City.

24-26 American Society of Mechanical Engineers, production engineering conference, Van Curler Hotel, Schenectady, N. Y.

25-27 Natural Gas Processors Association annual convention, Hilton Hotel, Denver.

29-May 1 Independent Petroleum Association of America, midyear meeting, Hotel Muehlebach, Kansas City.

29-May 1 Empire State Petroleum Association, spring convention, Statler-Hilton Hotel, Buffalo, N. Y.

29-May 2 Liquefied Petroleum Gas Association, annual convention and trade show, Conrad Hilton Hotel, Chicago.

30-May 2 Southern Gas Association, annual meeting, and American Gas Associa-

The illustration compares a 10-inch Duo-Chek Check Valve with a conventional check valve. In one application a 10-inch, Series 2500, Duo-Chek, which meets all ASA strength and design requirements except face-to-face size, is in continuous operation on a reciprocating compressor discharge line. A conventional swing check in this service would weigh over 5,000 pounds. The Duo-Chek weighs 285 pounds.

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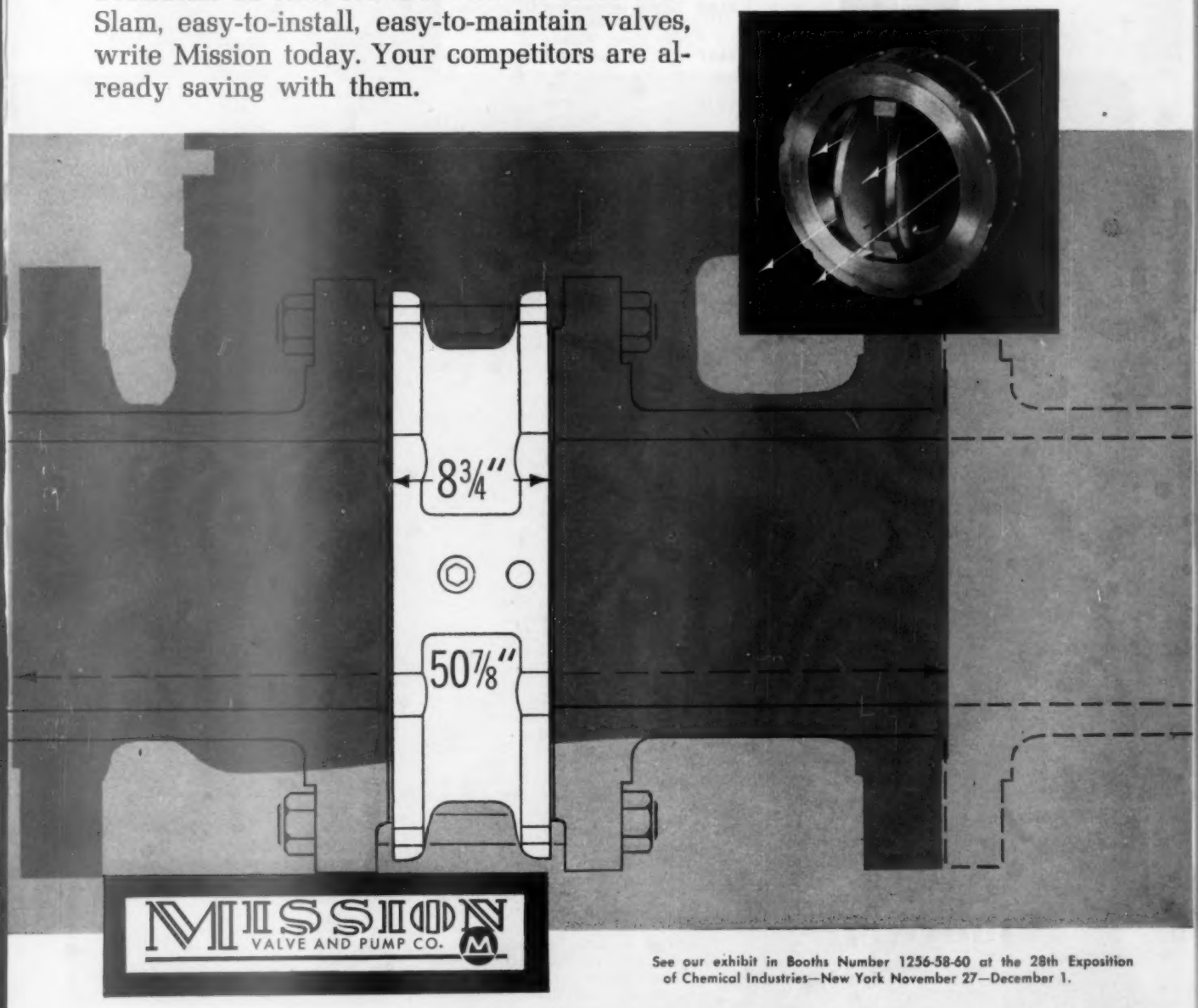

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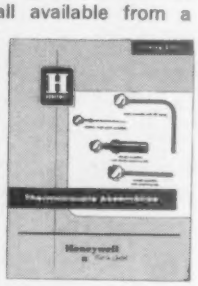

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tion, transmission conference, Rice Hotel, Houston.

30-May 2 API, Division of Transportation, annual tanker conference, Del Monte Lodge, Pebble Beach, Calif.

MAY

2-4 API, Division of Finance and Accounting, midyear meeting, Americana Hotel, Bal Harbor, Fla.

4 Chemical Institute of Canada, rubber chemistry division, Niagara Falls, Ont.

7-8 Society of Petroleum Engineers of AIME, North Texas section, fifth biennial secondary recovery symposium, Wichita Falls, Tex.

7-8 American Society of Mechanical Engineers, maintenance and plant engineering conference, Royal Orleans Hotel, New Orleans.

10-11 API Division of Production, Pacific Coast district meeting, Biltmore Hotel, Los Angeles.

11 Natural Gas Processors Association, Permian Basin regional meeting, Lincoln Hotel, Odessa, Tex.

11-12 Kansas Independent Oil and Gas Association, annual meeting, Broadview Hotel, Wichita.

14-17 API, Division of Refining, midyear meeting, Fairmont and Mark Hopkins hotels, San Francisco.

16-18 API, Division of Production, eastern district meeting, Deshler Hilton Hotel, Columbus, Ohio.

17-18 Society of Petroleum Engineers of AIME, production automation meeting, Hobbs, N. M.

20-23 American Institute of Chemical Engineers, national meeting, Lord Baltimore Hotel, Baltimore.

22-23 National Petroleum Refiners Association, computer conference, Hotel Tulsa, Tulsa.

22-25 API, Division of Marketing, midyear meeting, Queen Elizabeth Hotel, Montreal.

23-25 API, Division of Transportation, annual pipeline conference, Denver Hilton Hotel, Denver.

23-25 Eleventh National Telemetering Conference, Sheraton-Park Hotel, Washington.

24-25 AIME, Rocky Mountain petroleum sections, annual joint meeting, Billings, Mont.

27-30 Chemical Institute of Canada, Canadian chemical conference and exhibition, Macdonald Hotel, Edmonton.

JUNE

4-6 American Society of Mechanical Engineers, lubrication symposium, Deauville Hotel, Miami Beach.

10-15 American Society of Mechanical Engineers, summer annual meeting, Hotel Frontenac, Quebec.

13-14 National Petroleum Refiners Association, Mid-Continent regional meeting, Lassen Hotel, Wichita.

20-23 Canadian Gas Association, annual meeting, Manoir Richelieu, Murray Bay, Que.

24-29 American Society for Testing Materials, annual meeting and exhibit, Hotel Statler, New York.

25-26 Michigan Gas Association, annual meeting, Grand Hotel, Mackinac Island, Mich.

27-29 Automatic Control Conference, sponsored by Instrument Society of America, American Institute of Chemical Engineers, American Institute of Electrical Engineers, American Society of Mechanical Engineers, and Institute of Radio Engineers, New York University, New York.

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THE JOURNAL SAID

50 years ago

November 30, 1911

The great exodus from 26 Broadway (Standard Oil Building) of employes and officers of the more than 30 subsidiaries which will be divorced from the New Jersey company December 1 in compliance with the dissolution decree handed down by the United States Supreme Court last spring is getting under way. The employes are following their jobs to various cities over the country where the former subsidiaries are setting up their offices and organizations as separate companies.

Two complete well-drilling rigs have been purchased in the East for active prospecting for oil and gas to be started within 60 days in the McMinnville area of Oregon. A. D. Lord, of Portland, and his Portland and eastern associates hold leases on more than 10,000 acres in the territory bounded by the Coast Mountains, Willamette River, and Holmes Gap on the south, and Wapato Lake on the north.

Following the recent successful experiment in the use of electric motors for pumping oil wells in a California field, Virginia Oil & Gas Co. has decided to try electric motors on some of its wells in the Warwood, West Virginia, field.

25 years ago

November 26, 1936

Oil interests, most of them American and British-controlled, operating in Mexico face serious crisis from both a threatened general strike of Mexican oil workers, and the newly approved expropriation law. Confiscation of oil properties is feared.

A newly developed truck-mounted portable rotary drilling rig, first of its kind, is being tried out by Phillips Petroleum Co. on a shallow test between Pueblo and Colorado Springs, Colo. It was designed by John Jones, of Enid, Okla. It combines some of the features of a core drill and a lightweight rotary rig.

10 years ago

November 29, 1951

Plantation Pipe Line Co. places new 707-mile products pipeline from Baton Rouge to Charlotte, N. C., in operation. Completion of $52,000,000 18-in. and 14-in. line parallels company's 10-year-old 12-in. and 10-in. line, increasing system's carrying capacity 2½ times.

Standard Oil Co. (Ohio) announces $14,000,000 expansion program for its Toledo and Lima refineries.

JOURNALLY SPEAKING

Marketing profession?

"THE OIL INDUSTRY will never be straightened out until all the big companies are headed by marketing men," said one of the men around the lunch table.

"Not by a jugful!" exploded another. "It's the so-called marketing experts who are causing all the chaos in oil markets—the price cutting, the poor earnings, the unstable conditions, and all that.

"The trouble is that most of the people in charge of marketing for the bigger oil companies don't really understand marketing in the true sense of the word. They're just supersalesmen who worked their way up from the pump island. Most of them never really studied marketing. Marketers aren't trained in their profession like the technical people in the other divisions of the oil business."

"I'm inclined to agree," said a third man. "Not long ago I had a visit with an old friend who's a PhD in business administration and now is vice president of a big oil company.

"This man told me he is making an intensive study of his marketing division, but so far he hasn't been able to make any sense out of it. Other divisions of his company close down operations that lose money. They plug dry holes, surrender unpromising leases, sell marginal properties, junk obsolete refining units, and so forth.

"But the marketing division doesn't work that way. My friend said that when he asked his marketing men how they figure the payout on filling stations, and why they don't close out unprofitable locations and accounts, all he got was doubletalk. He said he has about concluded that they would rather lose their shirt than what they call their 'position' in the market."

"There's a lot to that," volunteered a fourth luncher. "I heard of a division manager who got called on the carpet because he closed a whole slew of junky little filling stations that were losing money and opened half a dozen big stations on a new superhighway in the same region. He sold more gasoline at less cost, but his bosses were mad because reducing the number of stations made the company lose position—whatever that is."

With that discussion still ringing in our ears, we went back to the office and started crossing our name off the routing slips of a pile of magazines the mailboy had dumped on our desk.

But something caught our eye. It was a letter from a reader to the editor of a magazine in an entirely different industry, complaining bitterly about marketing demoralization in his business and blaming it on poor management.

Professional management today, said this letter writer, is "committee management by echelons of Parkinson's Law executives" who fail to run a tight ship. Market researchers "come up with New Frontier numbers to be achieved by 1970," and this "seduces feather merchants" into the business and each allocates himself a big share of the expected increase in volume with the result that the industry has tremendous excess capacity. Then when the projected volume fails to materialize there is price demoralization "because old established companies are not content with a decreasing share of the business while holding a price umbrella over the newcomers." His recommended remedy was a "moratorium on market research by wet-behind-the-ears market researchers who never sold the markets they are researching."

Sounded a lot like what some people are saying about petroleum marketing.

And then—such are the workings of coincidence—we thumbed through the next magazine in the pile and caught this quote from Albert W. Frey, president of the American Marketing Association: "Marketing is not a profession, but it may become one in time."

That got us to wondering how much time it will be before oil marketing becomes a profession, and whether it will be in time.

—Henry D. Ralph

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Toward realism in gas regulation

THE FLAT STATEMENT that field prices of gas sold into regulated interstate markets will continue to be regulated in one way or another was made by three speakers at the API Chicago meeting—two from Government and one from industry.

Moreover, continuance of some sort of regulation is tacitly assumed in the carefully worded statement of principles adopted by producer as well as distributor and pipeline representatives on the industry "harmony group."

However much producers may say this is wrong in principle, unneeded in the public interest, and impractical of application, it appears they will have to accept the distasteful fact that producer regulation will persist.

THE IMMEDIATE PROBLEM, therefore, is what sort of regulation it will be. The former utility approach has been publicly renounced by the FPC and nearly everyone else with an objective view.

There is a growing swing behind an economic or commodity approach which recognizes the financial requirements of the industry in maintaining supplies and embraces a minimum of regimentation of individual producers.

This is the avowed intent of FPC in its current experiments with area pricing. But "area pricing" is capable of so many different meanings and applications that the original objective may become lost to sight.

Producers have grave doubts that area pricing will work. But their last best hope at the moment seems to be to give it a try—provided it can be held to the objectives that FPC professes for it.

The initial area proceeding (on the Permian basin) is barely under way, yet already there are signs that it is in danger of being derailed or wrecked by opponents of the "industry financial requirements" approach.

There are men on the staff of FPC and among the intervenor state utility commissions and distributors who would like to twist the area proceedings back toward the utility cost-of-service formula. And in the present state of the law they can find plenty of reasons for taking their views to court and thus delay, if not prevent, a practical test of FPC's experiment.

THE NEED FOR NEW LAW should now be obvious to all but obstructionists. If producers can't get complete exemption now—and that seems a forlorn hope—they should meet FPC halfway by supporting legislation to outlaw the utility formula and legalize a new method.

And if FPC is sincere in wanting to test its financial-requirements approach on an area-by-area basis, it should welcome legislation to give it a clear field for a fresh start.

There are no fundamental differences between FPC's financial-requirements concept, the incentive-price theory advanced by producers in the Permian case, and the statement of principles of the industry's harmony group.

Realism should dictate early agreement on a bill that will permit the experiment to proceed free from the legal impedimenta of the present law.

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Things were as they should be. The drilling crew made their final trip – 8945 feet, with a rich oil smell in the core samples – and observed the condition of the drill pipe as it came out of the hole.

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Gulftane poses a question:

What marketing pattern will emerge?

With Sun selling nine grades, Humble offering a middle grade, and Gulf now bucking the independents with a subregular, many marketers believe they are seeing history being made. But they wonder: how will it all wind up?

Gene T. Kinney
East Coast Editor

WHAT WILL HAPPEN to markets when Gulf Oil Corp.'s combat grade of gasoline goes nation-wide?

"I see nothing but turmoil and depressed prices ahead," said a major-brand competitor last week.

"We aren't about to give up our biggest customer appeal—the 2-cent differential," said a private brander, who then predicted, referring to Gulftane test cities where price wars have raged, "it will be San Antonio, Indianapolis, Norfolk, and Buffalo all over again."

"We hope that stability will result," said J. L. Lenker, Gulf's vice president for marketing. "We have every reason to believe it will have a constructive influence."

All three might agree with the marketing executive: "This is the biggest thing that's happened in marketing in the last 10 years. It may be the biggest in the next 10."

While Gulftane is the hottest item in marketing, there is much other evidence that this industry segment is groping for the pattern of the future. And no one is yet sure who has it, if indeed anyone does.

What will be the fate of the private brander's cherished 2-cent differential which has made him the dominant factor in some markets?

Does Gulf's adoption of a subregular as its third grade and Humble Oil & Refining Co.'s test with a middle grade portend the end of superpremium?

Does Sun Oil Co. with its blending pump dispensing up to nine grades have the answer to price competition and a wide range of car requirements?

Or do the stand-pat, two-grade marketers have the systems that will prevail?

1. Spread of Gulftane

The answer to some of the questions will not be long in coming.

For Gulf is pushing ahead with all haste to replace its superpremium Gulf Crest with the economy regular Gulftane throughout the company territory. Before the year is out Gulftane will be sold from the Rockies to the Atlantic Coast, according to Gulf officials.

Both Gulf regular and premium are being upgraded. Regular will be about 93½ to 94 Research octane number, it is understood, and premium will be a minimum of 100 RON. Gulftane will be about 2 octane numbers below regular.

Premium will remain 4 cents above regular at retail, and the Gulftane dealer price will be designed for a pump price 2 cents below regular. This means a price even with most private brands.

And that's what was happening in new Gulftane markets last week as the entire country outside the West Coast was rapidly being converted into a price laboratory.

Reaction to Gulftane. Private brands and not a few majors have been bitter in their criticism of Gulf's aggressive move.

They accuse Gulf of deliberately

How Whiteford sees Gulftane's advent

W. K. Whiteford, chairman of Gulf Oil Corp., last week had this to say about private brand competition and Gulftane:

On the private brand-major differential—"Private brands can murder the majors with a 2 or 3-cent spread. They once had 5% of the business; they now have 25%. We can't continue to let them sell the same quality of gasoline for 2 or 3 cents less."

Will Gulf settle for a 1-cent spread over private brands instead of meeting their prices with Gulftane? "We haven't any idea how this will settle down. We know an even price will keep business. The ultimate spread will depend on public acceptance. We are not inflexible on meeting private-brand prices."

On the sales distribution in Gulftane test markets—"About 30% was Gulftane, 30% Good Gulf (regular), and 40% No Nox (premium). The biggest surprise of the tests was the percentage increase in sales of No Nox."

On the effect on profits of replacing Gulf Crest superpremium with Gulftane—"There was no decrease in the average net profit in pool octane."

On Gulftane as a possible threat to industry gasoline prices and marketing profits—"If the competition is smart enough to maintain prices, there is no danger to profits. I predict next year will be more profitable for marketing."

Sun's Willard Wright
". . . Blending pumps give the customer the gasoline he wants and needs."

Humble's W. W. Bryan
". . . We're going to compete on the basis of quality."

Gulf's J. L. Lenker
". . . Gulf does not start price wars. We make a profit out of marketing."

"tearing up" markets in their drive to recoup business lost to price marketers. Some privately express admiration of Gulf for "getting the jump on the rest of us."

Some independents have accused Gulf of trying to run them out of business, using producing profits to finance price wars.

"Nothing would be further from the truth," replies Gulf's marketing vice president. "We make a profit out of marketing."

In the first place, Lenker says, Gulf does not start price wars. Gulf merely meets competition in quality and price. Unless someone else cuts, there is no price war.

"Any company is free to adopt this same program," Gulf says, "and it certainly does not represent the institution of a price-cutting program on the part of Gulf. What Gulf does will be conditioned by the behavior of its competitors."

A few years ago, Lenker recalls, surveys indicated that the leading factors in gasoline buying were convenience, personality of dealer, service, advertising, and brand acceptance. Price was well down the list.

But recent studies have revealed a deep shift in buying motives. Price, he says, now ranks among the top three.

Along with the recent trend to economy in automobiles, there has also been a profound change in the buying power among the motoring public. The numbers of both younger and older drivers have increased significantly. Both, with limited incomes, are inclined to be price buyers.

The classic example of this change is San Antonio, Tex., which for various reasons has become a price market. A few years ago it was a major-company market. Today the 20% of the stations making up the private-brand segment sell 50% of the gasoline, Lenker said.

"We have the responsibility to our thousands of Gulf dealers and to our hundreds of jobbers to assist in keeping them in business by being in a position to satisfy the price market," he added.

2. Humble's approach

Humble moved last week to substitute its Enco Plus in Texas and Esso Plus in the eastern test cities of Pittsburgh and Norfolk for its superpremium Golden.

Humble thus is experimenting with an entirely different approach, one that seems to ignore the price market.

"We aren't going after the price business," said W. W. Bryan, Humble's vice president for marketing. "We are going to compete on the basis of quality."

However, pricing is expected to follow the pattern established in the recent Gulftane and Sun markets, where the company stayed within 1 cent of the subregular grades.

Humble is offering a regular gasoline in the test markets that is about equal in quality to the standard regular grade. That would be upwards of 94 octane. The intermediate grade will be 95 to 96. The upgraded premium will be about 100.

The intermediate grade will be advertised in two ways to gage different appeals. In Texas, it will be billed as a "super regular," in the East, an "economy premium."

Pricing is expected to follow this pattern — an intermediate-grade tank-wagon price of 1.7 cents over regular, indicating a retail spread of 2 cents, a premium tankwagon 3.3 cents over regular, indicating a retail spread of 4 cents over regular.

Humble insists that its test is only a test, and not necessarily a prelude to wholesale junking of its superpremium. However, Bryan indicates that he should know within 2 months what the tests indicate, and that marketing decisions will be made accordingly.

3. Sun's approach

After marketing six grades through a blending pump for years, Sun last fall opened all nine stops on the pump in an unbranded test in New Castle, Del.

Its cent-a-grade station there, selling nine grades, including two subregulars priced 1 and 2 cents below major regular, enjoyed a 98% increase in gallonage.

This was the basis for Sun's entry into Charlotte, N. C., and later into the Gulftane markets of Norfolk, Indianapolis, and Buffalo, plus Fort Wayne and Chicago as well.

When Sun priced its bottom grade, 180, even with private brands in Charlotte last May, they accepted the challenge. With private brands running from Sun, and majors in hot pursuit, prices reached historic lows.

Suppliers at one time in order to maintain minimum dealer margins, were paying dealers 1½ cents a gallon to take gasoline off their hands.

Lately Sun has been going along with Gulftane in staying 1 cent above its price competitors with its lowest grade, which is Sunoco 190, in all test markets but one. Only in Buffalo is Sun still dispensing all nine grades. Sunoco 190 is priced 1 cent below Sun's regular grade.

Sales volume has increased in every area where Sun has installed the blending pumps, the company says. Expansion into other areas is under study.

"We think that in the blending pump we have the best device available to give the customer the kind of gasoline he wants and needs," says W. W. Wright, Sun marketing vice president. "The eventual test of the pump and its success naturally rests with the customer."

In Gulftane's wake, a 1-cent differential

The spread of Gulftane to nearly 100 Texas cities in the past 2 weeks has resulted in sharp price fluctuations in some cities and lesser changes in others.

But there is one general tendency developing: the traditional 2-cent differential between major and independent prices is being shaved to 1 cent.

In most cities the appearance of the Gulftane price sign meant an immediate cut by the majors to within 1 cent, and they have stuck with it. Where the independents have tried to cut below Gulftane, the Gulftane price likewise went down, and the majors followed suit, keeping the 1-cent differential.

In San Antonio, where Gulftane was inaugurated last summer, Mobil Oil Co. had matched the Gulftane price with its regular gasoline during the wild fluctuations in the market, but Mobil has not made this a general policy.

Corpus Christi was treated to a quick war when Gulftane appeared and the price fell by 4 to 6 cents. In the Rio Grande Valley cities, such as McAllen, a violent price war already was raging when Gulftane came on the scene. Independent gasoline was selling at 20.9 cents, and Gulftane entered at that price.

Gulf's timetable put Gulftane in the areas around San Antonio, Austin, Tyler, and Midland on November 10. A week later it spread into the areas around Dallas, Fort Worth, Wichita Falls, and Abilene. Four days later it went into the Houston, Galveston, Port Arthur, and Lake Charles, La., areas.

At the same time, other sections of the country were getting Gulftane.

In the Southeast: Norfolk, Va.; Charlotte, Wilmington, Greensboro, and Fayetteville, N. C.; and Spartanburg, S. C. In the upper Middle West: Detroit, Toledo, Cincinnati, and Indianapolis. And in the East: Wilmington, Del., and Philadelphia.

4. Multigrade picture

Gulf, Humble, and Sun represent the principal approaches to marketing of more than two grades, but they have plenty of company in the field.

Except for these variations, three-grade marketing means a regular, premium, and superpremium. Since Humble introduced Golden in mid-1955, some 40 marketers have offered three or more grades locally.

Changing car requirements. Superpremium's mixed and generally bad showing can be laid to many factors, including pricing, but the most important are these:

Change in emphasis in Detroit from high-performance cars requiring 100-plus octane gasoline to compacts and other economy models.

Improved premium gasoline so that a superpremium is required in only a tiny fraction of all automobiles on the road.

Today's average premium of 99.3 RON will satisfy about 97% of all cars on the road. And the upgraded premiums such as are offered by Gulf and Humble, and several two-grade marketers in prime markets, are good enough for all but 1 to 2% of the cars.

Also, it is evident that the average regular gasoline is much better than it needs to be for almost half the car population. But it isn't quite good enough for another large segment.

It is these facts that are among the influences guiding Gulf and Humble as they pursue their separate marketing strategies.

5. The future

The one sure thing about the future of marketing is that it will be different, and perhaps very soon.

It would be no surprise to see the demise of superpremium, at least in most of the country. Gulf has already given it up. If Humble drops it, competitors speculate, the days of all superpremiums will be numbered.

The moves of Humble, Gulf, and Sun are forcing all competitors to reappraise their own methods. This is especially true of Gulf's move. Being almost national in scope (only the West Coast is excluded), it makes participants of those who were only spectators watching test markets from outside.

Gulf believes it has the answer to two problems—price competition and the most profitable product mix. So does Sun, claiming the economy of a two-grade system for storage and distribution while offering several grades through the blending pump.

Humble is shooting for the large and increasing intermediate-octane market, while ignoring purely price competition. Its critical question is whether the new middle-grade customers will come from among buyers of regular or buyers of premium.

If tests show that Enco and Esso Plus will in the main upgrade regular customers, then look for Humble to go all out for its new system.

The two-grade marketers interviewed by the Journal still insist that their system offers the best economy for the motorist and the best profit for them. Asked how they planned to cope with the new market moves, the usual response was, "I wish we knew."

They generally believe they are eyewitnesses to marketing history in the making, but are at a loss to forecast the shape of the future. They are certain only that it will be hammered out in the marketplace, and that the transition will probably be expensive for all.

A new look at co-ops: they're doing all

But the busy enterprises—collectively as big as a major oil company—may be in for new tax levies. And tighter taxes could act as brake on growth.

D. H. Stormont
Refining Editor

ABOUT 20 years ago when the farmer cooperatives entered the oil business, they did so to assure a dependable source of supply at reasonable prices for their established marketing outlets.

This need no longer exists today, with excess supplies of petroleum products at depressed prices. But the co-ops have found that petroleum offers a good source of "margins" (profits in private industry). Thus they continue to expand in production, pipelining and refining even though these activities are no longer tied exclusively to farmers' markets.

Tracing the growth of these tax-free operators is difficult, since official figures are meager and outdated. The latest government statistics from the Department of Agriculture's Farmer Cooperative Service reflect 1957 operations, and updating is possible only by tracing the progress of some of the larger regionals through their annual reports.

The co-ops now provide more than 20% of farmers' fuels and lubricants. Of the approximately 55 million barrels sold last year through their stations, about 90% came from refineries they own or control.

Petroleum products of some regional farm co-ops amount to more than 70% of total sales. On average, they amount to about 25%, exceeded only by feed (37%) in annual dollar volume.

1. Growth record

Although local co-ops had been marketing petroleum products for many years, they didn't enter refining until 1940. By 1945 they had built or bought 10 plants. By 1948, 10 more were added.

Although this move was taken to assure supply, the rapid expansion into refining was triggered by other factors. Some plants were acquired primarily for investment. In some cases plants were remote from their owners' markets, and the co-ops sold to noncooperative customers. But as long as refinery margins remained high, these plants showed a good payout.

But when shortages were eliminated in the early '50's some co-ops found they couldn't compete with private industry in price or quality. Their plants were obsolete. In some cases, refineries were sold at substantial losses.

By 1955 the number of co-op refineries had shrunk to 16. Since then the trend has continued to fewer, larger plants. Today, 13 large regionals own or control only 10 refineries. But their capacity totals 163,000 bbl. per day as compared with 144,000 bbl. per day in 20 plants 10 years ago.

With the aid of outside construction-engineering firms, they have upgraded their surviving refineries. In downstream processing they compare favorably with the national average and are competitive in product quality.

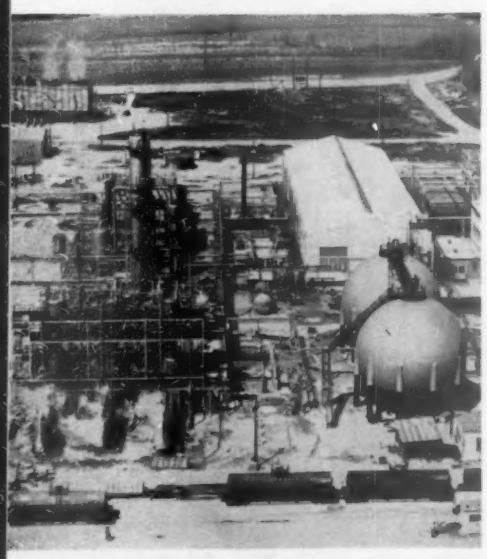
Production and pipelining. Co-op expansion didn't stop with refining. Several groups have acquired production and have laid crude and products pipelines. By 1950 they operated 1,945 wells with daily net production of 15,300 bbl., and owned 160 miles of crude lines and 258 miles of product lines.

The latest figures, for 1957, showed little further progress. Net production from 3,318 wells edged up to 17,300 bbl. per day. Crude pipelining remained unchanged but mileage in product lines grew to 694. Annual reports of the major co-ops indicate little change since 1957.

Marketing growth continues, however. In 1959 a total of 2,100 individual marketing co-ops handled $580 million in sales, up from $466 million in 1955 and $377 million in 1950. Oil products top all others in dollar sales of 8 of the 21 major regional organizations whose $332 million gross amounted to 30% of total volume.

The most progressive regional is Consumers Cooperative Association of Kansas City which does 56%

Fertilizers: co-op plants supply 25%



Co-op ammonia capacity

(Plants controlled or owned by co-ops)

Company, location	Capacity, tons daily
California Ammonia Co., Lanthrop, Calif.	120
Coastal Chemical Co., Pascagoula, Miss.	*200
Consumers Cooperative Assn., Hastings, Neb.	†200
Coop. Farm Chemicals Assn., Lawrence, Kans.	420
Mississippi Chemical Co., Yazoo City, Miss.	320
St. Paul Ammonia Products Inc., South St. Paul, Minn.	265
Valley Nitrogen Products, Inc., Helm, Calif.	150

*Capacity to be doubled. †To be completed about January 1.

of its business in petroleum products.

Other Products. Recently, the co-ops have moved strongly into LPG, ammonia and other fertilizers. LPG sales rose from 15 million gallons in 1950 to 91 million in 1957 and an estimated 110 million last year.

But private industry will feel the greatest co-op impact in fertilizers. Last year the cooperatives supplied about 25% of the 7.5 million ton fertilizer market. Studies by two research groups indicate that by 1968 they will capture 30% of the projected 10 million ton market.

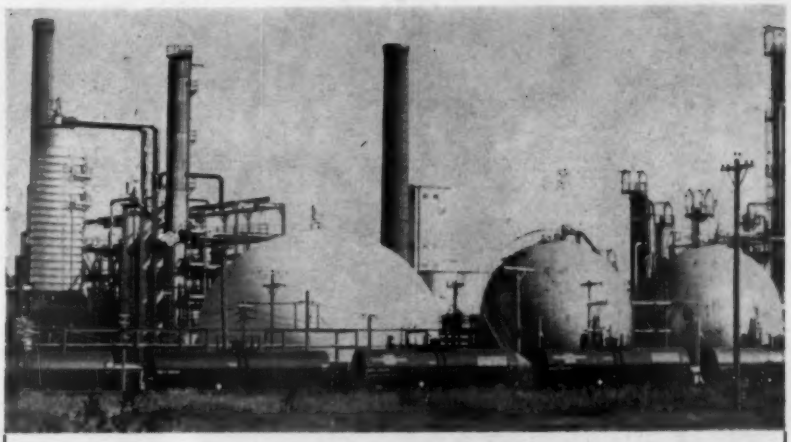
Six ammonia plants capable of producing 1,500 tons per day are now owned or controlled by co-ops. A new 200-ton plant is nearing completion at Hastings, Neb. and a 200-ton Pascagoula plant is being doubled. A third, 250-ton plant was just announced by a Farm Bureau group in Illinois and Indiana and two other regionals now plan new facilities. Total co-op capacity will probably reach 2,000 tons daily by next year.

This trend toward further integration in ammonia and urea manufacture stems from the co-ops' desire to provide patrons with low-cost nitrogen. Private industry will not only share a very minor portion of the future ammonia market, but will feel the effect of cooperative pricing.

The Yazoo City plant of Mississippi Chemical Corp. is a good example. While probably not typical of the newer plants, this project built in 1951 by 10 regional co-ops recovered their $5.7 million investment in 4 years. An additional $3.3 million was obtained from the Reconstruction Finance Corp.

During fiscal 1958 when the average price of anhydrous ammonia distributed by Mississippi Chemical was reportedly $88 per ton, the nonprofit organization declared a patronage refund of almost $32 per ton. Last year it returned refunds of $5 million to its 10,000 patrons.

Much of this success stems from tax exemption. During 1957 and 1958 when net margins totaled more than $8 million, the co-op paid only $200,000 in taxes.



Refineries owned, or controlled by co-ops

Plant, location—	Crude capacity, bbl. daily	Catalytic cracking, bbl. daily	Catalytic reforming, bbl. daily	Hydrogen treating, bbl. daily
Cooperative Refinery Assn., Coffeyville, Kans.	25,500	10,000	4,200	2,300
Phillipsburg, Kans.	14,000	5,000	2,500	3,500
Scottsbluff, Neb.	3,000	.....	800	.....
Farmers Union Central Exchange, Laurel, Mont.	20,000	8,000	4,450	5,160
Illinois Farm Supply (Pana Refining Co.), Pana, Ill.	5,500	.....	1,500	2,150
Indiana Farm Bureau Co-Op Assn., Inc., Mount Vernon, Ind.	12,500	3,960	3,000	2,100
Midland Cooperatives, Inc., Cushing, Okla.	13,000	5,300	2,580	.....
National Coop. Refinery Assn., McPherson, Kans.	33,000	13,500	5,000	8,000
Uinta Oil Refining Co., Rangely, Colo.	1,500	.....	.....	.....
Texas City Refining, Inc., Texas City, Tex.*	35,000	17,650	7,000	7,000
Totals	163,000	63,410	31,030	30,210

*Owned by Cooperative G.I.F. Exchange, Pennsylvania Farm Bureau Cooperative, and Southern States Cooperative.

Operations of California Ammonia Co. are of interest because of a unique organization. Best Fertilizer Co. supervised building the 120-ton plant at Lanthrop, Calif. and manages its operations on a fixed-fee basis.

The farmer shareholders buy fertilizer on the ratio of their investments to the net worth of the corporation. In effect, they own a capital interest in the company, but if they wish to participate in earnings, they must continue their purchases. The only avenue for returns is through patronage, since by-laws specifically state that no dividends will ever be paid on capital stock of any class.

Penalties are imposed on any customer who buys from another source and fails to take his full quota from California Ammonia. The over-all result is a cooperative organization since there are no profits—only margins or savings to customers.

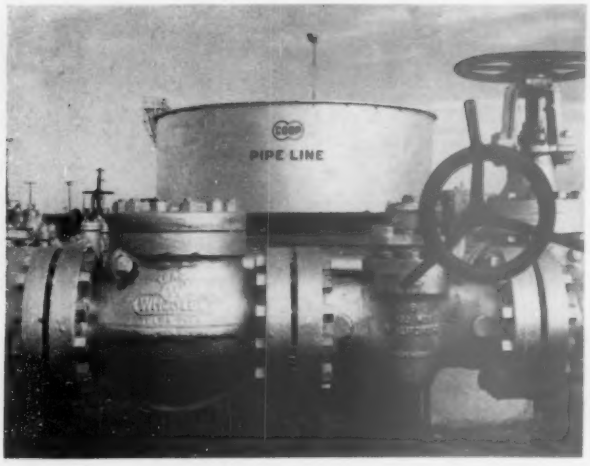
St. Paul Ammonia Products, Inc. likewise is not co-op owned. But Central Farmers Fertilizer Co. representing 20 regional purchasing and supply co-ops, acts as sole distributor and must conduct more than 85% of its business with co-ops.

2. The movement

Co-ops originated to help farmers and fruit growers sell their products. But the emphasis has shifted to manufacturing and purchasing.

Two important requirements qualify the co-op: it must conduct its operations on a cost-of-service basis and it must do more than 85% of its business with stockholder patrons.

Profits, or margins or savings re-



CO-OPS have a hand in pipelining, too, with a total of 160 miles of crude lines and about 700 miles of product lines.

ALTOGETHER, co-ops operate more than 3,000 wells with daily net production of more than 17,000 bbl.

sulting from services given and goods sold do not constitute income. They must be refunded to stockholders, and are not subject to corporate income taxes.

Whether the co-ops' preferred tax position is justified under the law requires careful analysis of each association's complex operations. But a point is being raised in tax circles concerning the handling of patronage dividends as a means of building up capital.

A co-op may choose to distribute a part or all of its net income as patronage refunds rather than as stockholder dividends. Further, the refunds may not be paid in cash, but as deferred participation certificates. These are non-taxable to the recipient until they are paid off.

The effect of this deferred payment plan is to set up a revolving fund of equity capital. A 1958 study by the Agriculture Department reveals that this is a widely used practice. It shows that of the $847 million gross equity capital of 1,157 reporting co-ops, 58% was reported as revolving fund capital.

Stiffer taxes proposed. The present administration has proposed that a co-op be allowed to deduct patronage dividends from its income, but that allocations would be taxable as individual income. Court rulings have held that deferred participation certificates are not taxable to the patron.

The administration also wants to levy a 20% withholding tax on patronage dividends. Both provisions would increase the co-op tax bill by some $25 million, according to Treasury Department estimates.

It is also proposed that patronage dividends be issued as script redeemable for cash in 90 days. If the farmer elected to have the co-op retain the dividend, he still would be liable for income tax on the allocation even though he didn't actually receive it.

The outlook. Future operations of regional co-ops would be vitally affected by tighter tax treatment. Some experts on co-ops believe, however, that they will continue to prosper as long as revolving funds offer a source of equity capital.

Because of the importance petroleum plays in the marketing operations of many regional co-ops, they will undoubtedly continue to expand their activities. But as long as the excess capacity in producing and refining continues there is little incentive for them to acquire new domestic properties.

It is noteworthy that a Consumers Cooperative subsidiary, Cracca Libya, Inc. holds an interest in the new National Oil Co. of Libya.

Pipeline briefs

A new pipeline will serve the reactivated eastern Oklahoma Muskogee field. The 25-mile, 4-in. line will connect with Mid-Continent Pipe Line's Bald Hill station. It will have a 12-mile gathering system. Current production in the area is 2,000 bbl. per day. It will be delivered to DX-Sunray's Tulsa refinery.

Construction of 167 miles of 30-in. loops and 57 miles of 36-in. loops is part of Natural Gas Pipeline Co. of America's 1962 program. Its Gulf-Chicago system would get 161.5 miles of 30-in. loops and its Texas Panhandle-Chicago system would get 57 miles of 36-in. and 5.5 miles of 30-in. loops. Also included are some 15 miles of 6-in. laterals in Jim Hogg and Zapata counties, Texas.

Construction of a gathering system in the Joyce Creek field, Sweetwater County, Wyoming, is planned by Caulkins Oil and Mountain Fuel Supply. Application for authority to build the 4½-mile, 4-in. line has been made to the FPC since the gas will go into Mountain Fuel's interstate system.

Mid-America Pipeline Co. has gone to the U. S. Circuit Court of Appeals for the District of Columbia to force Northern Natural Gas Co. and Northern Gas Products Co. to show cause why they should not be required to obtain certificates for the Bushton, Kans., extraction plant. Mid-America's original motion was denied by FPC. The Bushton plant and proposed pipeline facilities would compete with Mid-America's business as a common carrier for LPG.

Suppliers look for tame drilling year

PESA expects rotary-rig activity and well completions in 1962 to be shade below this year's showing. However, increase is predicted in footage drilled. Outlook for western Canada is better, report says.

THE nation's equipment suppliers are predicting another so-so year for drilling.

In its second annual survey, the Petroleum Equipment Suppliers Association said last week the number of rotary rigs operating and wells completed during 1962 should be slightly less than the total for 1961—but footage drilled should be slightly more.

In western Canada, the outlook is brighter.

Some 15 supply houses, equipment dealers, and manufacturers, plus one producing-industry association, respond to the survey of PESA's market-survey committee. A composite of their forecasts shows:

The nation will have 1,757 rotary rigs operating, on the daily average, during 1962, compared with 1,762 (a preliminary estimate) for 1961. This is a decrease of five rigs, or 0.3%. The rigs will drill 46,865 wells, compared with the preliminary estimate of 47,084 this year, down 219 wells or 0.5%. The wells will be drilled a total of 190.9 million feet, compared with an estimated 188.8 million feet this year, an increase of 2.1 million feet, or 1.1%.

For western Canada, the use of rigs should rise 3.9%, well completions 2.7%, and footage 2.4%.

In the rest of the free world, rotary-rig use should increase 2.7%, completions should remain about the same, and footage should rise 0.3%.

The PESA survey differs from that of The Oil and Gas Journal in that it represents primarily the thinking of the equipment and supply industry rather than the producing companies.

In disseminating the survey report to its members, PESA asked them to vote on whether to continue it in future years.

Citing the pro-and-con conditions affecting drilling in 1962, the committee said earnings of integrated oil companies rose 8% during the first 9 months of 1961, compared with a like period in 1960, and gross national product next year is expected to rise 7.7% over this year. Industrial production should rise at least 10%.

On the minus side, the committee found that demand for domestic crude has increased only a negligible amount over the past 6 years, and the nation's capacity to produce crude continues to be in excess of demand.

Low allowables, particularly in Texas, have cut income of producers who do a large amount of the nation's drilling. The committee also found that "weakness" in the domestic price structure is a source of concern, and a similar weakness in world crude prices, aggravated by Russian moves, could further threaten the domestic price structure.

Equipment purchases climb slightly

THE oil industry increased its purchases of equipment by about 1.17% during the first 9 months of 1961 over the same period last year.

A report to the Petroleum Equipment Suppliers Association by Price, Waterhouse & Co. shows total net sales at $518.8 million for the January-September period, a rise of $6 million over the same months in 1960.

In a breakdown of sales, the survey reports that steel tubular goods showed a respectable increase of 8.2% for the period, up from $216.6 million to $234.4 million. Oil-country tubular goods gained sharply, while line pipe and other pipe fell.

Equipment other than steel tubular products suffered a drop from $296.2 million to $284.84 million, down 4.2%. Virtually all items were down slightly. These included rock bits, drilling equipment, and valves and fittings.

Twenty supply houses and manufacturers participate in the quarterly survey.

Corrosion-engineer board being formed

THE NATIONAL Association of Corrosion Engineers (NACE) is setting up a board to certify its members in the U. S., Canada, and Mexico.

Creation of the board will climax 4 years of planning by the 6,,000-member NACE. It became interested in upgrading the professional status of corrosion engineers after several state legislatures started seeking corrosion-protection requirements for gas and fuel-oil pipelines.

To qualify for a certificate, NACE specifies that the applicant be a legally registered professional engineer in his state of residence and that he supply evidence of at least 4 years of solid experience in corrosion engineering.

NACE directors, meeting this week in Miami, Fla., will elect members of the board of review from this list of nominees:

Dr. Hugh P. Godard, Aluminum Laboratories, Ltd., Kingston, Ontario; George E. Best, executive secretary of the Manufacturing Chemists Association, Washington, D. C.; Humberto Lobo, Fabricas Protexa, Monterrey, Mexico; Dr. Norman Hackerman, University of Texas; T. J. Hull, NACE executive secretary, Houston; and L. L. Whiteneck, member of the San Diego Port Authority.

Workover rates to rise for Gulf Coast,

Contractors say higher labor and equipment costs are crippling them, and they plan to raise charges on well-service rigs by 17%. Time: next month.

OIL producers along the Gulf Coast and in South Texas face an increase in prices for well-service rigs next month.

Well-service contractors from Beaumont to the Rio Grande are preparing to set rates some 17% higher than they've been since 1956, the last time contractors got a raise.

Chief reason for the new raise: higher labor costs. But equipment prices also have risen sharply in the past 5 years, and this is a factor, too.

The majority of the servicing and workover operators in the area regard their business position as precarious and see no escape except through higher prices. Most expect to have their individual price schedules in the mail within 30 days.

One Houston operator told the Journal last week: "We have allowed ourselves to get in such poor shape because of competition. We're simply not getting a return on our investment any more."

Even this may be an understatement. The credit manager for one service-rig manufacturer says several prominent well-service contractors in the Gulf Coast area have fallen far behind in rig payments to his firm.

"It isn't poor business practice," he says. "These fellows just aren't getting enough for their equipment to meet all their expenses. Most of them are faced with giving a wage increase, and, if they do, they'll be operating in the red all the time. As it is, they go in the hole any time they have to pay overtime."

The rates. Presently a typical double-derrick workover and well-service rig in the Gulf Coast brings about $22 per hour total, including labor.

Under the new schedules, prices may reach $25.

By far the largest item of increase in the hourly scale will be wages.

A rig with a four-man crew currently is paying its two helpers or floormen only $1.50 per hour in the Gulf Coast. These men will be raised to $1.80.

The derrickman also gets $1.50. He will go to $1.90. The unit operator will be raised from $2 to $2.30.

Further, there is some talk that the labor bill for toolpushers will be handed to the producer. This would be true particularly where producers want a toolpusher to handle only one rig instead of perhaps three or four, as he does now.

One contractor says he will ask the companies to pay $35 per day for a toolpusher. The average contractor now is paying from $1,000 to $1,200 per month for the salary, car, and other expenses of a toolpusher.

Because of fluctuating wage factors, the contractors also may change their billing methods by charging producers separately for labor and for any special equipment required on a well. At present, all this is lumped into a single hourly charge, and the contractor bears personally the cost of overtime, extra pumps, and other unforeseen cost items.

Labor squeeze. Service contractors fear they will lose their help if they don't raise wages.

A garbage man working for the city of Houston is better paid than derrickmen and floormen on well-service rigs, and the chemical plants and refineries in the area pay starting wages of better than $2 per hour. Even a flagman for the State Highway Department gets $1.65 per hour.

"We simply can't compete in the labor market," one contractor said. "Operators of these rigs are not common labor. We expect them to run an $85,000 rig without much supervision."

Equipment. In the past 5 years, equipment and supplies have risen in cost.

The rigs themselves are up well over 10%, and such items as hydraulic tongs are up 36%.

Nipples (1-in. by 6-in.) cost 18 cents in 1956 and 26 cents today, up 44.4%.

"Enough little items like that can eat a big hole in your budget," a contractor noted.

Areas. The distress of Gulf Coast and South Texas operators is probably greater than in most other areas of the oil patch.

About one-third of the 450 contractors in Texas are located in this area, and they have competed fiercely for business.

An effort to raise rates a year ago failed because some of the larger contractors refused to go along. Indeed, there is no guarantee that the increase this time will be unanimous.

In South Texas, where labor generally is paid less than along the Gulf Coast, the rate increase probably will be smaller.

Higher drilling

CONTRACTORS in South Texas, West Texas, and the Rockies were moving rapidly last week to raise wages for their drilling crews.

But they were moving in two different directions—some cutting to a 48-hour work week with no cut in weekly take-home pay, others simply granting a 10% pay hike on 56 hours.

There is no clear-cut indication as to which pattern will eventually prevail in the drilling industry. Evidence available now points to a continuation of this split-wage picture for months—perhaps as long as 1 or 2 years.

Contractor wage action during the past week was virtually a standoff. In South Texas, the pattern appeared overwhelmingly in favor of the short week. In the Rockies, most contractors were raising 10% and staying on 56 hours. West Texas contractors, as predicted by the Journal (OGJ Oct. 23, p. 84), split pretty much down the middle, with most bigger operators going to the short week.

South Texas moves. At least eight contractors headquartered in the

South Texas

There has been talk of an increase in West Texas, but one contractor in the Midland area said rate increases have occurred gradually in recent years, and no abrupt boost is expected. There is more automation in West Texas operations and, therefore, fewer labor problems.

Louisiana and Kansas are considered low-priced areas by the service contractors, and these states may well experience a rate increase in the near future.

The Rocky Mountain area is considered in "better shape" by one authority. One schedule in Montana, for example, shows a rig drawing 15% higher rates than a similar one in Texas.

What contractors say about rig costs

IN PROMOTING their case for an increase in rates, Gulf Coast workover and servicing contractors are circulating the following cost figures for a typical contractor.

The costs are based on "very conservative depreciation" and with no allowance for maintenance and repairs. They reflect the operation of a typical double-derrick rig costing $150,000.

	Regular time hour	Overtime hour
Labor	$ 6.80	$10.20
Taxes (Soc. Sec.)	0.41	0.62
Insurance (labor)	0.72	1.08
Depreciation	10.00	10.00
Rig insurance	0.42	0.42
Overhead	3.19	3.19
Total	$21.54	$25.51
Charge per hour	22.00	22.00
Profit	$ 0.46	−$ 3.51 loss

crew wages spread through Texas, into Rockies

Goals. Gulf Coast contractors are anxious to defend their increase.

"We want to see our part of the industry upgraded," says a veteran contractor who fears that the operators of service and workover rigs have fallen into a "second-class citizen" status.

"These producing companies depend heavily on us, but they don't realize the serious condition we have fallen into," he said. "I feel that they won't object to this increase once they get the whole picture."

area had cut to a 48-hour week with no decrease in take-home pay and others were on the verge of doing so. No contractors were reported going the 56-hour, 10% pay hike route.

The eight contractors already known to have acted operate 38 rigs. They include: Storm Drilling, Corpus Christi, 7 rigs; Turnbull & Zoch Drilling, Corpus Christi; 4 rigs; Field Drilling, San Antonio, 6 rigs; Southland Drilling, San Antonio, 6 rigs; Stewart & Gouger Drilling, San Antonio, 4 rigs; Well Drillers, Inc., McAllen, 2 rigs; John Voss Drilling, McAllen, 4 rigs; and Monte Christo Drilling, McAllen, 5 rigs. At least two other area contractors operating 9 rigs, were reported to have adopted the short week.

The new pay scale on 48 hours in South Texas calls for payment of $3.52 an hour for drillers, $2.66 for motormen and derrickmen, and $2.54 for floormen. This compares with the previous scale of $2.86 for drillers, $2.16 for motormen and derrickmen and $2.06 for floormen.

R. A. Bushman, vice president and general manager of Field Drilling, said both major and independent oil firms so far appeared receptive to rates Field has had to charge to meet the raises.

Turnbull & Zoch reportedly has renegotiated contracts with majors on all four of its rigs to reflect the cost increases. And three of Southland Drilling's six rigs were reported already at work at the higher prices.

West Texas changes. Rigs operating in this area are about equally split between the two wage patterns, but the bulk of the big contractors have adopted the short week.

In this group are: BBM Drilling, Midland; Rowan Drilling, Fort Worth; Sharp Drilling, Midland; A. W. Thompson Drilling, Houston; Great Western Drilling, Midland; Delta Drilling, Tyler; Moran Drilling, Wichita Falls; and Carl B. King Drilling, Midland.

Contractors going the other direction include: Llano Drilling, Midland; Tri-Service Drilling, Midland; Helmerich & Payne, Tulsa; Forster Drilling, Odessa; B. L. McFarland, Midland; and Parker Drilling, Odessa.

The West Texas pay scale on 48 hours grades downward from $3.52 an hour—the same as in South Texas.

Those granting a simple 10% pay increase are now paying a scale grading down from $3.14 an hour for a driller. Of this group, two firms said they plan to remain on this scale temporarily, going to the short week as soon as personnel problems it poses are worked out.

Raises in Rockies. Contractors were still acting rapidly at midweek to raise wages, with the great majority boosting 10% on 56 hours.

Only one area contractor, Hewit-Gulick Drilling, Denver, was reported to have adopted the short week. Raising 10% were: Brinkerhoff; Signal Drilling, Denver; R. L. Manning, Denver; Rutledge Drilling, Santa Fe; True Drilling, Casper, Wyo.; and others.

Previously, Rowan Drilling and Delta Drilling had cut to 48 hours for their rigs in the Rockies.

New rates there are slightly higher than in Texas. Under 48 hours, drillers get $3.58 an hour, motormen and derrickmen get $2.72,

and floormen received $2.60.

Operators back boost. W. P. Clements, Jr., president of Southeastern Drilling and the American Association of Oilwell Drilling Contractors, said last week "that major companies are actually the same as asking contractors to adopt the short week and bill them for 20% more money."

The oil companies, he said, made this plain when the drilling-crew wage problem was put on the agenda and discussed by the general production committee of the American Petroleum Institute at its recent annual meeting in Chicago.

"Further proof," he says, "is that the majors—as a general rule—are accepting these higher costs for work in progress in South Texas, West Texas and wherever contractors have gone to 48 hours. They are actually renegotiating contracts where drilling was already under way.

"We're gradually losing our old, experienced hands and we're not attracting good new ones. We never will attract them, if we insist on our men working 7 days a week. The majors see this. And the thing they fear—and the last thing they want—is to have to go back to operating their own rigs with the attendant terrific costs.

"Their quick acceptance of the 48-hour week is positive proof . . ."

Long-range plan. Cutting now to 48 hours, Clements says, is only the first of several wage steps he hopes the contracting industry will take in the next 4 to 5 years.

If the majority of contractors adopt the short week, and put this plan over, he says it should be possible and feasible to grant a straight 10% wage hike within the next 1 or 2 years.

The next step then would be to cut the work week to 42 hours. And then, probably within the next 4 to 5 years, raise wages another 10%.

The cumulative effect of all this, Clements says, would be to raise a driller's wages to roughly $5.00 an hour and give him and other crew members 2 days off each week.

Such a program, he says, would put the drilling industry back on a sound footing in its competition with other industry for good, high-caliber labor.

Steed hearing indicates

Government witnesses dodge attempts to pin them down on how administration actually regards control program.

THE present administration has not yet developed any clear-cut, long-range policy regarding oil-import controls.

This seemed evident from testimony of government witnesses last week before the House Small Business Subcommittee No. 4, which is holding hearings on the oil-import-control program.

Some government witnesses, including Oil Import Administration officials, said that over-all policy decisions were not in their jurisdiction. Others, including Frank B. Ellis, director of the Office of Emergency Planning, carefully sidestepped efforts to pin them down on the administration's thinking or future course.

In fact, Ellis indicated that his office, at least, is awaiting the outcome of two special studies before it formulates further import-policy recommendations, aside from revisions now under consideration.

One of these studies, Ellis said, will be done by the recently created special subcommittee of the Foreign Petroleum Supply Committee. Industry experts will assist the Government in making worldwide supply-demand studies.

The study will provide a more dependable basis for determining the adequacy of our petroleum supply in an emergency, Ellis said.

"It will have a bearing on import controls."

He indicated that the group's study would be available by mid-1962.

The second project mentioned by Ellis is a study under way for 3 years by Interior's Office of Oil and Gas of long-range petroleum requirements and availability.

"It is now expected that Interior's report will be available early next year, at which time it will be appropriate for the interdepartmental committee, under the direction of this agency, to formulate policy recommendations," Ellis said.

The Office of Emergency Planning itself, Ellis said, has made no special study of the national security need for crude-oil-import controls.

However, it does have such studies under way on residual-fuel-oil and asphaltic-crude imports, Ellis said. Decisions on these are pending.

Ellis also mentioned the current consideration being given to proposed changes in the present crude-oil controls, but declined to elaborate on this "until it at least has been completed and has been submitted to the President."

Rep. Tom Steed (D.-Okla.), chairman of the subcommittee, said Ellis would be called back later, perhaps in January, "when he can give us better information."

Tone of hearings. It is obvious that the chief aim of Steed's subcommittee is to set the stage for a more vigorous control program.

Time and again, Steed questioned witnesses about the importance of the oil industry to national security and welfare, and about the present health of the domestic industry and its ability to meet emergency demands.

Another subcommittee member who was active in the questioning was Rep. Arch A. Moore (R.-W. Va.). Moore, like Steed, emphasized the national-security need for a healthy domestic fuels economy. Moore, from a coal-producing state, placed particular emphasis on the effect of residual-fuel-oil imports.

Course of hearings. The subcommittee's hearings began last Monday and will continue through this week. They may lap over into next week.

In addition, there will be further hearings after Congress reconvenes in January.

Government witnesses were scheduled at the outset of the hearings last week. They were being followed by representatives from state conservation commissions, trade associations (including coal), and individual company presentations.

there's no long-range imports policy

One of the sharpest opinions of all came from Ernest O. Thompson, senior member of the Texas Railroad Commission.

Thompson was not present, but he sent a statement by William Murray, commission chairman.

In his statement, Thompson challenged the need for any imported crude oil at all.

"We can produce easily our oil requirements, so why in all fairness should we restrict our production to let in foreign oil?" Thompson asked. (For excerpts from Thompson's statement, see box.)

Murray, who did testify in person, also strongly expressed the view that imports are hurting the domestic producing industry badly.

"Imports should be immediately cut back sufficiently to restore to the domestic producer markets lost because of the favored position of imports," Murray said.

"Then imports should be held to a predetermined percentage of domestic production and be permitted to absorb only their ratable portion of increased demand and be required to participate ratably in any reduction in domestic production.

"This is essential to security, conservation, and consumer welfare," Murray concluded.

Porter's views. Frank Porter, president of American Petroleum Institute, who rarely testifies at a congressional hearing, was present at this one.

He said he didn't think there was any responsible body of opinion today which is against all petroleum imports.

"The principal disagreement," he said, "has to do with the level of imports and the method of determining that level."

He did not say what he thought the level should be, but he did indicate that the domestic industry is in a position to meet a "considerable" increase in demands.

As to the effect of imports upon our capabilities to meet the nation's need for petroleum," he said, "it seems evident that imports are not a currently pressing factor."

Dissenting voice. The only sharply divergent view expressed in the early stages of the hearing came from a spokesman for the Department of State.

Clarence W. Nichols, special assistant to the assistant secretary of State for economic affairs, said that while government intervention in the oil market may be necessary, "it should not be pushed beyond the point of diminishing returns."

"In assessing what Government should undertake, one must consider the need of the economy for low-cost fuel, the effect of import restrictions in this country on our efforts to open up foreign markets for the products of American farms and factories, and the stake of American investors in oil production abroad. We also must consider the security effect of political repercussions in friendly countries dependent for a livelihood on oil."

Nichols also minimized the risk of U. S. dependency on foreign sources for part of its oil requirements.

In the event of a "brush-fire" war, he reasoned, foreign oil would still be available because of the wide dispersal of oil-producing nations today.

And, he concluded, any war so general in nature as to involve submarine attack would also likely involve damage to ports, refineries, railroads, highways, and consuming areas.

"Because of such damage, available supplies of both oil and solid fuels might be surplus to requirements during such all-out conflict," he said.

Thompson speaks his mind on imports

THE following are excerpts from a statements sent by Ernest O. Thompson of the Texas Railroad Commission to last week's oil-import-control hearing in Washington:

"Every barrel of oil imported means one less barrel of market for domestic crude.

"If 1.8 million barrels of crude and products are imported daily, as now, the U. S. producers are denied that 1.8-million barrels daily. Why prefer other oil?

"We can produce easily our oil requirements, so why in all fairness should we restrict our production to let in foreign oil? Are we to surrender our markets? Is this to the benefit of the consumer, or to national defense?

"Can we depend on foreign oil, come war?

"How much further do they expect us to restrict oil production in Texas? Do they expect us to carry the whole load of restraint? We are on 8 days a month now.

"Such a policy of preferring foreign oil over domestic oil is slowly but surely putting the independents out of business . . .

"Canada and Mexico are not under import restrictions. Why not have them share the burden by including them under the quota?"

Rotary-rig activity takes healthy jump

U. S. ROTARY-RIG activity hit a 23-month high in the week ended November 20.

Hughes Tool Co. reports 1,905 rigs were operating that week.

It was the first week since December 28, 1959, that rig activity passed the 1,900 mark.

The 4-week average was 1,868.

The cumulative average for this year—the average of all weekly reports—is 1,738. This is one above the average for the corresponding period last year.

Last year's 52-week average was 1,747 rigs. Recent trends point to an average of about 1,752 rigs this year.

Oklahoma changes allowable formula

New rules give a bonus for both deep drilling and wide spacing. Higher allowables apply to wildcats and existing wells. The over-all aim: to encourage more exploratory drilling in the state.

LONG-AWAITED incentives for new exploration and deeper drilling in Oklahoma are now a reality.

That's the interpretation pinned on action last week of the Oklahoma Corporation Commission in approving:

1. New formula for discovery allowables on new wells.

The new table allows a discovery of up to 1,000 ft. deep to produce at the rate of 20 bbl. daily for 200 days. The table scales up to a maximum allowable of 303 bbl. daily for a period of 1,050 days for wells 15,000 ft. and deeper.

Under previous rules, the discovery allowable was twice the basic daily allowable for wells in pools of comparable depths and characteristics for a period of 30 days.

2. A new basic depth-acreage yardstick for monthly oil allowables.

The commission for the first time approved Table A in Section 303 of Oklahoma's new general rules and regulations which gives weight both to average depth and acreage in fixing a well's production allowable.

The commission modified the table, however, to provide a minimum allowable of 25 bbl. daily for wells of 2,000 ft. or less on 10-acre spacing. The same well on 20 acres will get 31 bbl. daily and on 40 acres 39 bbl. daily. The table ranges up to 593 bbl. daily for wells 15,000 ft. and deeper on 80-acre spacing. All the basic allowables, however, are subject to a percentage factor based on market-demand conditions.

In putting the new allowable formula into effect for December, the commission voted to apply a demand factor of 40%. This means a minimum allowable of 10 bbl. daily and a maximum of 237 bbl.

The new allowables are expected to produce about 525,000 bbl. daily during the month or 14,000 more than November production in Oklahoma.

What it means. Ray Jones, vice chairman of the commission, declared the new discovery allowable and new formula for monthly allowables will give the Oklahoma oil industry a shot in the arm.

"The incentive to explore has just about faded out of the picture," he said. Jones added the discovery allowable will tend to build up reserves, encourage deep drilling, and still impose some production controls to protect the crude market.

Officials of the Oklahoma Independent Petroleum Association presented the proposal for the new discovery allowables. State Conservation Director Dan Dunnett in turn asked the commission to approve the new monthly allowable table. The table has been drawn up for months but was held up pending a study of its possible effects on existing wells.

The twin actions met with the approval of both the independent and major company representatives present at the hearing. It was one of the most harmonious sessions in months.

E. A. Smith of Tulsa, president of OIPA, said the new discovery allowable will be a step toward stopping the decline in Oklahoma's reserves.

"There is evidence that unless some incentive is given the industry to find new reserves, Oklahoma will lose its present markets because of inability to meet the demand," he said.

J. M. Linehan, vice president of Sunray Mid-Continent Oil Co., said the new allowable should shorten the pay-out period for new wells. This will encourage wildcatting especially in deeper areas where Oklahoma's future production lies.

Commonwealth Oil to merge

Houston company to become a division of Jupiter and operate oil and gas properties of both firms.

COMMONWEALTH Oil Co., a Houston firm which once held huge leases off Florida and now operates an offshore gas-gathering system in Louisiana, will be merged into Jupiter Oils, Ltd., a diversified Chicago company.

A Houston spokesman said Commonwealth will operate the oil and gas properties of the two companies as a division of Jupiter.

The shareholders of each company must approve the merger. Commonwealth has 5,389,638 shares outstanding, valued at $1.50 to $1.625 per share. Jupiter will be converted shortly to a Delaware corporation and be known as the Jupiter Corp. Commonwealth shareholders will receive preferred stock in the new company.

Commonwealth at one time held all or part of nearly 4 million acres in two blocks off Florida and participated in drilling several wells, all dry.

The company also held concessions in Haiti, but these were dropped when three tests were dry.

Commonwealth pioneered offshore pipelaying with its barge, "The Magic," which laid the first gas line in offshore Louisiana. The company still operates the 8-10-in. line, which moves 150 million cubic feet of gas daily from Rollover field off Vermilion Parish to dehydration plant at Lake Arthur.

Rate boost doesn't hurt University of Texas leasing sale

THE University of Texas banked nearly $1,800,000 last week in high bids from its November 14 sale of oil and gas leases.

In all, the university leased slightly over 29,000 acres of its West Texas lands at an average bonus of about $61.60 an acre. This is about standard for recent lease sales in the state. And Jerry Sadler, state land commissioner, termed the results of the auction highly satisfactory.

This was the university's first lease sale since it raised the going royalty rate to one-sixth from the old one-eighth. The sharp hike appeared to have little effect on operator interest.

The sale's highest bids were submitted by Atlantic Refining Co. for three blocks of acreage in Reagan County, only 3 miles from Big Lake field where oil was first discovered on university land. Atlantic bid a total of $362,000 for 823.3 acres 3 miles west of Big Lake field.

B-A pays $3 million for Mississippi oil production, pipeline

BRITISH-AMERICAN Oil Producing Co., Dallas, has bought for $3,000,000 the oil-producing and pipeline properties of Weston and Larco Drilling companies in Bolton field, Mississippi.

The purchase includes varying interests in 29 wells averaging 2,150 bbl. of oil daily. It also includes Weston's 30-mile 3,000-bbl. crude line from Bolton to a terminal on the Mississippi River near Vicksburg, and the same company's interests in the Bolton crude and gas-gathering and salt-water disposal systems.

Earnings from the properties are subject to a 50% net profits interest retained by Gulf Refining Co., the original assignor.

Bolton, a multipay field, produces from the Paluxy, Rodessa, and Hosston sands at depths ranging from about 8,800 to below 12,000 ft.

WATCHING WASHINGTON

with Clyde La Motte

Administration is making haste slowly on import plan

FATE of the oil-import-control program is still uncertain.

Last week John M. Kelly, assistant secretary of Interior, met his counterparts from other government departments to discuss Interior's proposals with the White House staff.

There were quite a few critical comments from State Department spokesmen and others. However, no one offered an alternative program.

The next step will be for the White House staff to make its report to the President. If he accepts the basic plan Kelly presented, approval will be forthcoming shortly. However, if he has objections or reservations, a cabinet discussion may follow. At least it is likely that Secretary of Interior Stewart L. Udall will be called in to confer with the President.

Time is running short for any major overhaul of Interior's plan. So if there is much more delay, look for a simple extension of the present program—with a promise of action later.

Independents map plans in new drive for imports cut

INDEPENDENT producer groups are becoming increasingly alarmed over the possible outcome of the import-control-program revision.

They fear that Interior's plan may be scuttled, and they were already unhappy over the fact that the cut in crude imports being sought by Interior is only about 50,000 bbl. daily. They wanted a reduction of around 250,000.

As a result, an "urgent" meeting of the liaison committee of cooperating oil and gas associations was set for last Sunday. The purpose: "To coordinate our campaign for a more effective oil-imports program," a spokesman said.

Maybe more questions like this one need to be asked

OVERHEARD at the congressional import-control hearing:

Rep. Arch A. Moore (R.-W. Va.), a member of a House subcommittee probing the impact of oil controls, was questioning a witness about the use of residual fuel in East Coast plants. Moore wanted to know if it wasn't true that some oil companies were encouraging greater use of residual fuel.

In the pause that followed the congressman's question, a voice in the audience could be heard clearly throughout the room. "Why not?" the unidentified spectator asked.

Consensus in the corridors was that this was about the most appropriate question asked all day.

Interior, California to discuss offshore leasing

HERE AND THERE in Washington:

Federal leasing of some offshore California areas is becoming a distinct possibility. Interior has appointed a special committee to work with Justice Department and California officials to draft an agreement to permit drilling even though the dividing line between state and federal areas is still unsettled.

IPAA has challenged FPC Chairman Joseph Swidler's Chicago statement that natural-gas producers must be regulated to protect public interest. IPAA said Swidler's philosophy would lead to end-use control of fuels and a return to chaotic wartime conditions of rationing and price controls.

Afterburner cost may be set at ½-cent a mile

Staff report by California board recommends ½-cent figure in determining costs of antismog devices for automobiles. For average California driver, cost would run in neighborhood of $47 a year.

CALIFORNIA authorities have given their first indication of what they think smog-control devices for autos should cost.

The state hasn't set a retail price, but has suggested the device not cost the motorist more than ½ cent a mile to operate. The ½-cent figure is recommended in a staff report made to the Motor Vehicle Pollution Control Board, the state agency which must approve two devices before they are mandatory on all California cars.

The ½-cent figure would not only cover the initial cost of an afterburner, but also catalyst replacement costs for catalytic afterburners and added gasoline consumption or maintenance which would result from direct-flame afterburners.

The average California motorist would pay a maximum of $47 a year for smog devices, according to the report. This is based on the ½-cent figure and an annual mileage of 9,416 miles, the average for the state.

D. A. Jensen, the board's executive secretary, gave cost breakdowns on two examples which would meet the ½-cent-a-mile limit he recommends.

Catalytic device. A catalytic afterburner which costs $70 factory installed on new cars and $150 when installed on used cars would meet the limit. This theoretical device would need a life of 5 years, a catalyst life of 1 year, and a catalyst replacement cost of $10.

For a new car with a 10-year life, the motorist would spend $300 for this device. The $300 covers $70 for the factory-installed original, $150 for a replacement in 5 years, and $80 for eight catalyst replacements, one each year other than the year the devices are installed. This would be an annual cost of $30 and a per mile cost of 0.32 cent.

For a used car with a 5-year life, the catalyst afterburner costs would total $190. This total covers the $150 cost of the unit plus four replacements. The annual cost would be $38 and the per mile cost 0.4 cent.

Some type of crankcase control device would be needed with the catalytic afterburners, but Jensen figures the cost for these at only $5 factory installed and $15 on used cars, so these totals would not run the total control costs over the ½-cent limit.

Direct-flame device. For the direct-flame afterburner, the costs given by Jensen are a little higher, but this type of afterburner controls both crankcase and exhaust emissions. And the costs are within the limits recommended.

The factory-installed price for the direct-flame device was set at $85 by Jensen. Installed on a used car, the price would be $180. On a new car with a 10-year life, the motorist would invest $265 for the original and a replacement in 5 years plus $40 on maintenance cost at $5 a year for all years other than the years the devices are installed.

Jensen estimated a direct-flame device would increase gasoline consumption $10.50 a year.

For the new car with a 10-year life, the total control costs would be $41 annually or 0.44 cent a mile, still under the ½-cent figure.

For a used car with a 5-year life, the annual figure hits $50.50 or 0.54 cent a mile, which is just over the limit.

Jensen pointed out his examples did not cover induction systems, but said this type of control is not expected to cost more than $10 factory installed and $75 on used cars. The induction-type control would be well within the limits if this type of system proves workable.

Over-all costs. The MVPCB staff study shows the California motorist driving a late model, medium-priced car has an over-all operating cost of 9½ cents a mile.

Using the average mileage of 9,416 for the state, gasoline and oil run 2½ cents a mile or $235 a year. Tires and tubes run ½ cent a mile or $47.08 a year, repairs and maintenance 1½ cents a mile or $141.24 a year, and insurance 1.3 cents or $122.41 a year.

Applications. At its latest meeting, the MVPCB reported it is processing nine applications for auto exhaust devices.

The board is testing six catalytic devices, two direct-flame afterburners, and one induction system. Once two devices are certified, afterburners will be required on all California cars within 3 years.

The latest application covers a direct-flame device submitted by McAlester Aircraft Co., Los Angeles. Chromalloy Corp., Hawthorne, Calif., has submitted the other direct-flame afterburner. Standard Products Co., Cleveland, Ohio, has the only induction system before the board.

The six catalytic mufflers have been submitted by Universal Oxidation Processes, Inc., a Universal

Industry briefs

Propane deliveries have started from Texas Eastern Transmission's new 19-million-gallon storage cavern at Todhunter, Ohio. The cavern raises LPG-storage capacity at Todhunter to 65 million gallons. Texas Eastern has a 200-million-gallon supply terminal at Mont Belvieu, Tex., from which the LPG moves to Todhunter by pipeline.

Consolidation of district offices in the Oklahoma City area is planned by Humble Oil & Refining Co. Offices at Seminole, Purcell, Shawnee, and Elk City, Okla.; Wichita, Great Bend, and Liberal, Kans.; and Pampa, Tex., will be closed by mid-1962. Exploration and production operations now handled by those offices will be shifted to enlarged district offices at Ardmore,

Oil Products Co., subsidiary; Arvin Industries, Inc., Columbus, Ind.; Wolverine Tube Division of Calumet & Hecla, Inc., Allen Park, Mich.; Oxy-Catalyst, Inc.. a Houdry Corp. subsidiary; Davison Chemical Division of W. R. Grace & Co.; and Walker Manufacturing Co., an American Cyanamid Co. affiliate.

First underwater test in Alberta to be in Buffalo Lake parcel

ALBERTA is setting the stage for its first underwater drilling project.

The provincial Government is selling reservations on a 10,480-acre parcel in Buffalo Lake north of Stettler. Three wildcats currently are being drilled near the lake (OGJ, Nov. 20, p. 274).

Alberta's Oil and Gas Conservation Board is drawing up a set of rules for underwater drilling. The board has indicated it will approve drilling in other lakes if the Buffalo project works out.

Terms of the reservation sale require the operator to drill a well into the Elk Point - Devonian in order to acquire a lease on 20 quarter sections. And the operator must post a $200,000 bond before doing any drilling in the lake.

Weather "key" to Buffalo line

If snow season is severe, extension of Interprovincial system this winter would be too costly an undertaking.

WITH one eye on the approaching snow season, Interprovincial Pipe Line Co. last week weighed the hazards of going ahead with its extension from Hamilton, Ont., to Buffalo, N. Y.

The National Energy Board a week ago approved the 90-mile 12-in. line to deliver crude to Ashland Oil & Refining Co.'s 30,000-bbl.-daily refinery. Mobil Oil Co. has a refinery with 31,500-bbl.-daily capacity at Buffalo, but the initial installation does not include a spur to this plant.

Both Ashland and Interprovincial are interested in the earliest practicable completion. The winter freezeup next month will put an end to tanker deliveries of 10,000 bbl. daily from Interprovincial's Bay City, Mich., terminal to Ashland. It will take at least 60 days to lay the line, and probably longer if the usual winter weather prevails. Bad weather could make construction costs prohibitive.

One of the more difficult construction problems will be the Welland Canal crossing. The line also must cross the Niagara River.

Ashland started taking Alberta crude at Buffalo last May to supplement U. S. supplies. The company prefers Canadian to domestic crude because of price and quality, especially for petrochemical manufacture. Added to the normal incentive for cheaper raw material is the fact that Buffalo has become a gasoline-price-war area.

Ashland has guaranteed throughput of 10,000 bbl. daily to Interprovincial, and so can be expected to take this minimum volume. Initial authorized capacity of the line is 20,000 bbl. daily. Once installed, the pipeline will offer a tempting incentive to purchase of the full volume.

If Interprovincial desires to increase the capacity, it will have to go back to the NEB for approval. It is considered only a matter of time until Mobil becomes a Canadian customer. The uncertainty of Canada's continued exemption from import controls has been a deterrent up to now.

Details of the U. S. imports-control program for next year have not yet been released.

Okla., Amarillo, Tex., and a new office at Enid, Okla.

Westward, Inc., Denver, has sold its principal assets to McCulloch Oil Corp., Los Angeles, for 90,000 shares of McCulloch stock. McCulloch acquired 40,000 acres of leasehold and royalty interests, primarily in Colorado's Sand Wash basin, from Westward along with $105,000 in cash.

Interest in 11 wells located in Lindon and Bison fields, Colorado, has been purchased by Sage Oil Co., Inc.

Oregon's royalty rate for wildcat acreage which may be leased in the state's tidelands has been set at 12½%. The Oregon Land Board says it may change the royalty on any proven acreage. Oregon's tidelands have never been drilled, but some acreage may be put up for bonus bidding next spring.

Gulf Oil's speed-drilling techniques are still paying dividends. Adapting methods used earlier in South Louisiana, Gulf went to 8,000 ft. in 5 days and 22 hours in its Gulf State Tract 739 No. 1 northwest of Port Isabel, Tex. This shaves 2 days off Gulf's 3-week-old record of 8 days for the same depth (OGJ, Oct. 30, p. 106). Contractor on the new well is Brewster-Bartle Drilling Co.

Proposed new name for Dorchester Corp.—Dorchester Gas Producing Co.—is being submitted to company stockholders. The gas producing and processing firm owns 237 gas wells, a field-gathering system, and three gasoline plants in Oklahoma and Texas.

Acquisition of Hostetler Engineering, independent producing and operating engineering firm, has been completed by White Eagle International, Inc. Both are headquartered in Midland. Hostetler will operate as a division of White Eagle. The sale included 115 net producing oil wells in West Texas.

Interest in Mercedes field, Texas, gas production is being acquired by Tex-Star Oil & Gas Corp. The firm has contracted to buy the properties for $840,000 from Delhi-Taylor Oil Corp. and Loring Cook Foundation, Inc. Properties include working interest in eight gas wells and overriding royalty interests on three gas producers.

Allied acquiring Union Texas in stock deal

Merger will let big chemical firm get into oil-and-gas production without taking on marketing headaches. Allied also gets welcome feed-stock supply.

UNION TEXAS Natural Gas Corp. of Houston, born of a merger less than 2 years ago, is being acquired by Allied Chemical Corp. in a $350-million exchange of stock.

Allied, one of the nation's largest chemical companies with rapid growth in petrochemicals, will gain the big supply of feed stocks it has been seeking. More than $100 million of the company's projected $750 million in sales this year will be from petrochemicals, including polyethylene, nylon, phenol, isocyanates, and aniline.

Allied also will realize an ambition for diversification into the oil-and-gas producing business without assuming the burden of gasoline marketing.

The complementary nature of the firms was pointed up only 2 weeks ago when they announced a joint $40-to-$60 million petrochemical complex to start within 6 months near Baton Rouge, La. (OGJ, Nov. 20, p. 151). The complex will process 20,000 to 25,000 bbl. daily of natural-gas liquids to produce a variety of aromatics and olefins. A naphthalene plant also is planned.

"Further discussions (arising from the joint venture) resulted in a proposed merger," the companies explained last week.

Stock exchange. The stock-exchange proposal, to be approved by stockholders at a date to be set later, was announced by Kerby H. Fisk, Allied chairman, and J. Howard Marshall, chairman of Union Texas.

Union Texas stockholders would receive seven-eighths of a share of Allied Chemical for each share of Union Texas. The petroleum firm has 7,256,000 shares outstanding. On the day of the merger announcement, Allied Chemical was traded at $56 and Union Texas at $35.75 a share.

Allied earned $41.3 million, or $2.57 a share, on sales of $766 million last year. Union Texas earned $14.2 million, or $2.01 a share, on sales of $82 million.

Union Texas assets. As of September 30, Union Texas had $165 million in assets, mainly in 14 natural-gasoline plants and oil-and-gas producing properties in the U. S., Argentina, Venezuela, Bolivia, and Canada.

For the first 9 months of 1961, production was: natural gas, 238,147 M.c.f. daily; plant residue gas, 89,764 M.c.f. daily; natural-gas liquids, 25,612 bbl. daily; and crude oil and condensate, 17,226 bbl. daily.

Proved liquids reserves at the end of 1960 were estimated at 67.6 million barrels, with just over half being condensate and natural-gas liquids and the remainder crude. Proved reserves of natural gas were estimated at 1.7 trillion cubic feet.

Union Texas was the product of a merger in February 1960 between Union Oil and Gas Corp. of Louisiana and Texas Natural Gasoline Corp. The company last August acquired five-sixths interest in the producing properties of Anderson-Prichard Oil Corp., Oklahoma City.

Union Texas also is one of the owners of an LPG line being built from Houston to Raleigh, N. C.

The company has 1,400 employes in the field and in its main offices in Houston and Tulsa.

In Houston last week there was speculation that Union Texas' offices probably will remain intact, and the company would operate as a division of Allied. This, however, is subject to the negotiation terms.

Processing briefs

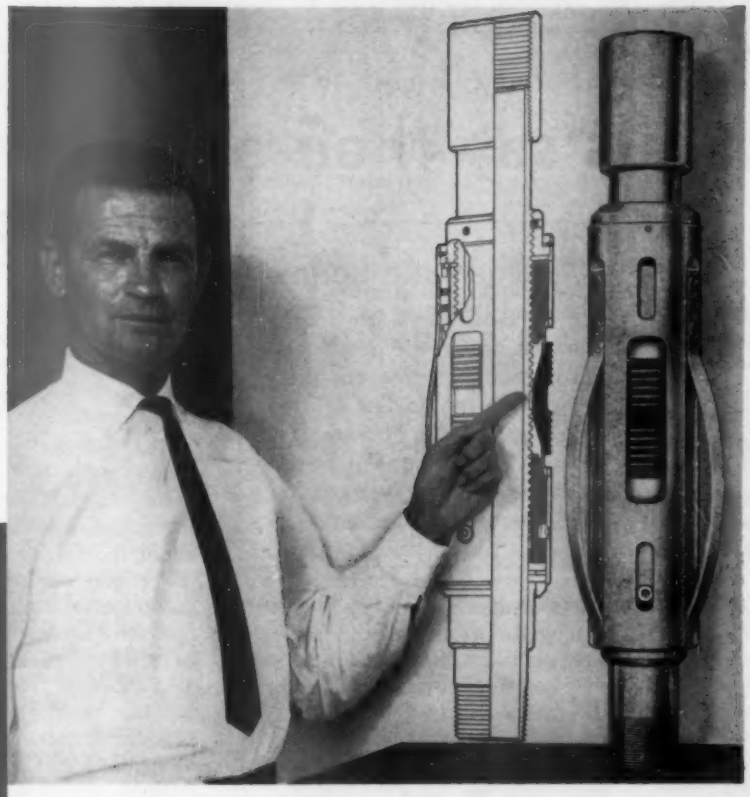
Gas processing plant with a capacity of 32,000 M.c.f. daily will be built at Normanna field in Bee County, Texas, by Tidewater Oil Co. The low-temperature, absorption-type plant will produce 86,500 gal. of liquids daily. Completion is set for May with Hudson Engineering Corp. as contractor. Tidewater, with a 30% interest, will operate the plant for a group of companies.

Closed-loop control is slated for two of the four primary oxidation units at Celanese Corp.'s Bishop, Tex., petrochemical plant. Company estimates the RW-300 digital computer will pay out in 2 years as a result of increased productivity and efficiency. The computer will control 24 process variables and sense about 150.

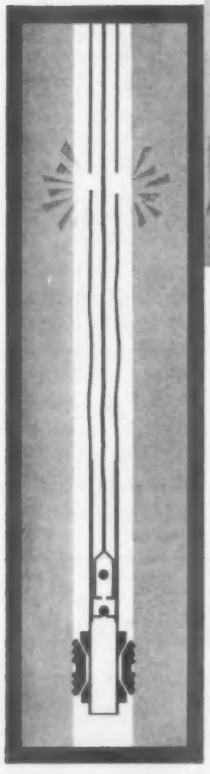
Gasoline consumption during the fourth quarter is expected to be 4,180,000 bbl. per day, a 1.5% increase over fourth quarter 1960, according to Dupont's petroleum chemicals division. The firm says this year's gain will be the smallest annual increase in demand since the war years.

Two helium extraction plants will be built by Phillips Petroleum under an agreement signed with Interior Department. One plant in Hansford County, Texas, will process 200,000 M.c.f. daily; the other in Moore County, Texas, will process 275,000 M.c.f. daily. Over a 22-year period Interior will buy 15.7 billion cubic feet of helium for $10.30 per M.c.f., or $13.7 million per year. Phillips expects to have both plants operating within 14 months. This is the fourth helium contract signed by Interior and exhausts its current appropriations for the expanded helium conservation program.

Alkylation and isomerization units have been completed at American Oil Co.'s Texas City refinery. Production capacity of the alkylation unit is 14,600 bbl. per day—the world's largest. Capacity of the butane-isomerization unit is 12,600 bbl. per day. The new units are part of a multimillion dollar modernization program at the refinery.



"This no-movement slip-cone design makes the Baker Anchor-Catcher different..."



Catches Tubing Before it Falls!
No free fall should the tubing part. Possibility of a coincident rod part is greatly reduced.

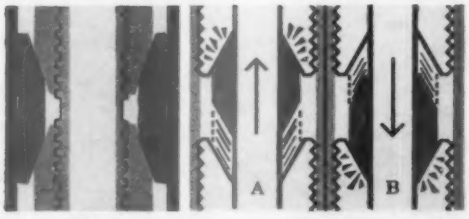
NEW BAKER TUBING ANCHOR-CATCHER COMPLETELY ELIMINATES VERTICAL MOVEMENT AT ANCHOR

Even deep wells can now be pumped more efficiently and with greater safety, because of Baker's "no movement" anchor-catcher principle.

Is no movement really important? It is... both in anchoring and catching tubing. This anchor-catcher stays exactly where you set it. Because it can't move downhole, it won't overstress tubing. Its positive, no-movement grip maintains the proper tension, once applied, to eliminate breathing and buckling... thereby reducing tubing and coupling wear and assuring maximum pumping efficiency.

The Baker Anchor-Catcher stays put—virtually catching parted tubing *before* it falls. The possibility of rod parts is greatly reduced and fishing jobs are simplified.

To learn more about the way in which this new Baker Anchor-Catcher (Product 698-B) can help you produce more oil at less cost, write for Bulletin 391. Baker Oil Tools, Inc., P.O. Box 2274, Terminal Annex, Los Angeles 54, California.



WITH A BAKER ANCHOR-CATCHER there is no movement after setting, because both cones are in full wedge-contact with the slips, which are in grip-contact with the casing.

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Incentive gas pricing—4

Producers say their approach guards

Henry Ralph
Chief Editorial Writer

THE incentive-price method of regulating the field price of natural gas is in the public interest because it can keep consumer prices from rising unduly in the future and may even reduce them.

This theme was explained in detail by a group of producer witnesses at the Federal Power Commission's first area-pricing hearing, dealing with the Permian basin, in Washington last month.

The paradox of higher field prices now bringing lower consumer prices later is explained by these economic facts:

1. The gas transmission and distribution industries are "decreasing-cost" industries. The greater their volume, the lower their unit costs; and the more gas a consumer uses, the lower his rate per cubic foot.

2. The gas producing business is an "increasing-cost" industry. The more demand increases, the more it costs to find and produce additional supplies.

3. About 85% of the consumer price of gas is accounted for by transmission and distribution, so this portion of the price will decline as the industry grows. The other 15% is accounted for by production costs, which will increase as demand grows.

4. Therefore the key to lower consumer prices is continued expansion of transmission and distribution systems, and this can be achieved only by assuring reserves adequate to supply expansion.

5. Reserves are not now sufficient to permit much more expansion. On the contrary, contraction will set in within 6 to 12 years and then consumer prices will rise regardless of the level of field prices.

6. Because of the time lag in finding and developing new gas reserves, higher field prices now are required to give producers the incentive to provide the reserves which will prevent consumer prices from rising sharply a few years from now.

Another in a series

THIS article is the fourth in a series on the producers' case for incentive gas pricing. Like the earlier articles (OGJ, Oct. 30, Nov. 6, and Nov. 20), this one is based on testimony given at an FPC hearing last month.

"Gas supply is the key to the economical operation of the transmission and distribution segments of the industry," said one producer witness, Roger L. Conkling, a consulting economist.

"With an adequate gas supply, these segments have the backup for effective merchandising. They can invite higher customer consumption. They can encourage new and improved consumer uses. They can set into motion and accelerate the forces in the economics of their operations which lead to decreasing costs. In short, a sufficient gas supply unlocks the door to the fulfillment of their inherent ability to achieve diminishing unit costs."

1. Reserves and demand

A sufficient gas supply to achieve this desirable result is not available at present, other witnesses testified in detail.

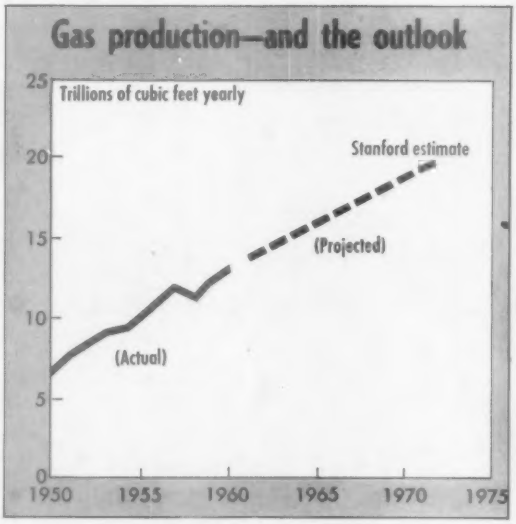
The current reserves-production ratio is about 20 to 1, which the experts consider about the minimum for safety. But because of the declining production curve inherent in the nature of all gas reservoirs, present reserves can maintain full-line deliverability at the current rate of production for much less than 13.5 years for the nation as a whole, and for much less than in some producing areas such as the Permian basin.

Moreover, that estimate is based on average takes throughout the year. In only about 10 to 12 years the present reserves will be unable to meet peak-day-deliverability demands during the coldest winter weather.

Rising demand. But nobody thinks that the demand for gas is going to

How U. S. demand WILL grow . . .

Six recent studies all predict that the 1970 demand for gas will be far above the 1960 production of 13 trillion cubic feet. Latest study, prepared by Stanford Research Institute expressly for Permian-basin hearing, is about in the middle of the range of these forecasts.



public interest

remain at the present level. One economic witness, Samuel Joseph, cited six forecasts of future demand made recently by different agencies. Their estimates for 1970 consumption ranged from a low of 17.3 trillion cubic feet to a high of 20.9 trillion, compared with the 1960 consumption of 13 trillion cubic feet. An elaborate forecast made expressly for this hearing by Stanford Research Institute was about in the middle of the range, with a 1970 estimate of 18.9 trillion cubic feet.

Taking the SRI forecast as representative, Joseph calculated that during 1961-1970 we must increase reserves an average of 28 trillion cubic feet per year in order to maintain a 20:1 reserves - production ratio

"But," he said, "the gross reserves added since 1956 have been clearly downward. In 1960 we added only 14 trillion cubic feet, barely as much as we produced. During the last 4 years we have been falling farther and farther behind in finding enough gas to give the pipelines, distributors, and consumers assurance of their needed future gas requirements.

"The real problem is not the precise volume that we added in any particular year; rather it is the rate at which we are searching for new reserves. It is the exploration rate that must be increased if any particular year's increased discoveries are to have long-term meaning.

"The leverage of an increasing production rate is so great that even if the reserves found in 1961 are in the neighborhood of 20 trillion cubic feet and if the production rate only increases by 3%, the reserves-production ratio will nevertheless remain at about 20 to 1."

2. Monetary factors

The public's financial stake in this situation was heavily stressed by several of the producers' expert witnesses, particularly Joseph.

The present gross investment in gas pipeline and gas distribution facilities is approximately $21 billion, and only about $5 billion of this has been recovered through depreciation charges, leaving $16 billion still to be recovered, he said.

Payments angle. A still more important factor, often overlooked by consumers, is the fact that most pipeline and distribution systems are financed under indentures which require that payments into the sinking fund to retire the bonds must be increased whenever it appears that the company may not have a full-line load for a period long enough to pay out on the original schedule. This would require the company to increase its prices while its volume of business declines.

"If a pipeline does not have to increase its sinking-fund payments and correspondingly its depreciation rates," said Joseph, "the distributors and consumers will be saddled with an increased price without an increased supply of gas. Clearly, an adequate supply of gas for a long enough time to pay out the bonds is an absolute must for the pipelines and distribution companies."

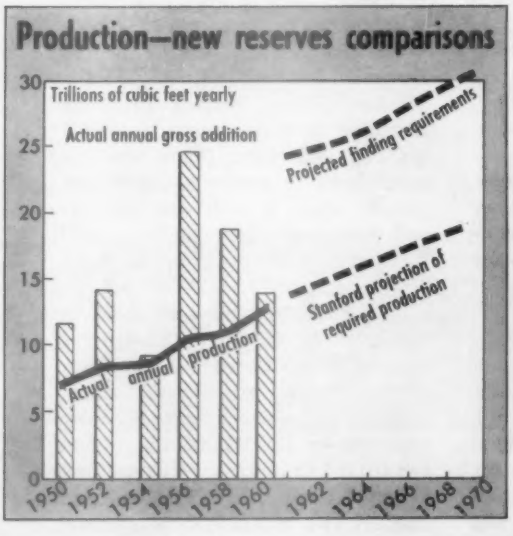
Why more gas reserves are essential

AFTER an exhaustive study of the Permian basin, expert witnesses concluded that if present reserves are drawn on at the 1960 rate, production will be insufficient to meet demand in 1967. Then pipelines out of the Permian basin will be operating at less than capacity, unless new reserves are developed in the meantime. The Permian basin's reserves-production ratio has declined from 25.5 to 1 in 1950 to 17.1 to 1 in 1960.

For the United States as a whole, which has a reserves-production ratio of 20.1 to 1, these experts estimate that if all the reservoirs were new, the breaking point would come in about 14 years. But since many fields are partly depleted, the breaking point will come within 11 to 13 years even if production does not rise above the 1960 volume. The ability of present reserves to meet peak-day deliverability will end a year or two earlier than that.

This is a sample of the type of evidence presented to FPC to prove that consumers will benefit from a field price high enough to encourage development of additional reserves of natural gas.

. . . How reserves NEED to grow



Using the Stanford forecast of demand, producers' expert witnesses told FPC that new reserves must be added at rate shown in chart at left, if reserves-production ratio is to be kept at 20 to 1. This would avoid "breaking point" at which deliverability would start decline.

Ten Texas recovery projects pending

Railroad Commission already has approved two artificial drive programs. Eight others are in final planning stages. Altogether, they'll boost recovery by about 100 million barrels.

NEW artificial drives are on tap in Texas which would hike oil recovery from nine fields by more than 100,000,000 bbl.

One, a San Andres dolomite flood taking in more than 1,000 acres in Sharon Ridge 1,700-ft. field in Scurry and Mitchell counties, was approved by the Texas Railroad Commission.

This project, a cooperative venture of Creslenn Oil Co. and Graridge Corp., would use a five-spot pattern to hike oil recovery by an estimated 7,760,000 bbl.

The other projects include:

A big gas-injection program and unit planned for TXL Devonian field in Ector County. Shell Oil Co., projected unit operator, estimates program with initial cost of $380,000 will hike oil take from reservoir by about 17,000,000 bbl.

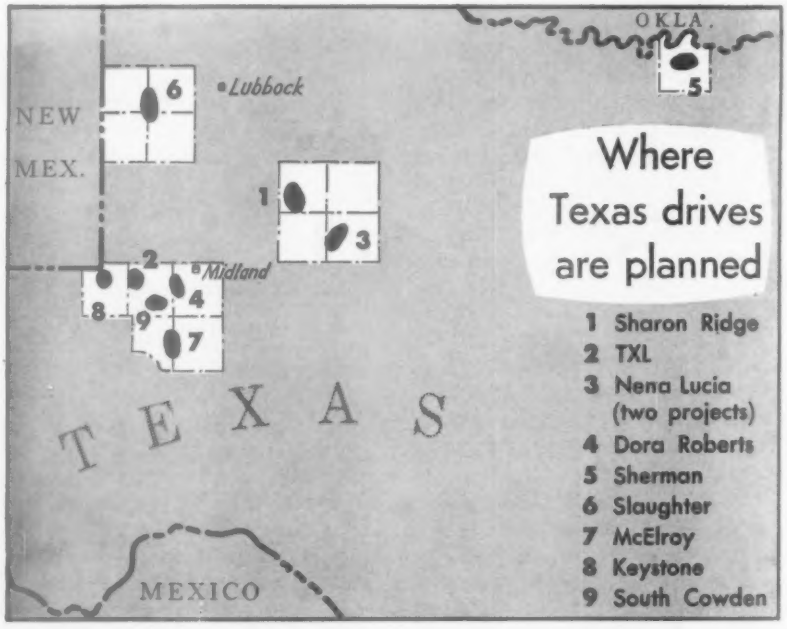
The drive would affect the entire 4,500-acre reservoir. Plan is to inject gas from the TXL Devonian, San Andres, Tubb, and Goldsmith 5,600-ft. zones into a secondary gas cap which has developed along the crest of the reservoir.

Two unitized projects in Nena Lucia (Strawn Reef) field in Nolan County, West Texas, involve injection of both gas and water.

Sun, proposed operator of one unit, predicts added recovery of 12,000,000 bbl. of oil from a $1,600,000 pressure-maintenance program covering about 7,500 acres in the southwestern portion of the field. Plans call for reinjecting produced gas into the gas cap and injecting water from the Cambrian sand below the water-oil contact in the 6,887-ft. Strawn reef reservoir.

Operator of the other Nena Lucia unit, already approved, is Skelly Oil Co. Skelly estimates added recovery from this 5,000-acre north unit, at more than 5,000,000 bbl.

An expanded gas program is planned in big Dora Roberts (Devonian) field in Ector and Midland counties. Cities Service Production Co. expects to hike oil take from the Devonian about 13,000,000 bbl. by expanding a pilot-gas-injection project to affect 5,560 acres.



Company will inject high volumes of gas at high pressures. Estimated daily input per well is 1,600,000 to 2,500,000 cu. ft. at wellhead pressures ranging from 4,500 to 6,500 psi.

Combined gas-and-water injection into the 8,900-ft. Pennsylvanian pay in Sherman field of Grayson County, North Texas, is planned.

Standard Oil Co. of Texas, proposed operator, figures pressure maintenance will increase oil recovery from the pool by about 8,300,000 bbl. This compares with a primary recovery figured at about 6,600,000 bbl.

A big San Andres flood is planned by Pan American Petroleum Corp. under three leases in Slaughter field of Hockley and Terry counties, West Texas. Pan Am will flood the 5,000-ft. dolomite pay under a total of about 3,000 acres comprised by its Slaughter "E" and "G" and W. G. Frazier "B" leases. Estimated added oil recovery is at least 15,000,000 bbl.

An 8,140-acre flood by Gulf Oil Corp. in the Grayburg reservoir in McElroy field, Crane and Upton counties, West Texas, is expected to hike oil recovery by a minimum of 7,000,000 bbl.

Another Gulf project, a pressure-maintenance program, calls for both water and gas injection in the big Devonian reservoir in Keystone field, Winkler County, West Texas. The company will inject gas into the gas cap and water below the oil-water contact under a 2,040-acre project area. It will use one gas and three water inputs. Total field production since discovery in April 1946 is roughly 13,000,000 bbl.

A 1,185-acre unit and flood in the 4,500-ft. Grayburg dolomite zone of South Cowden field, Ector County, West Texas. Project would jump ultimate oil recovery from reservoir by 12,700,000 bbl. Union Oil Co. of California, proposed unit operator, will drill 13 inputs and convert two producers to injection service.

XP-20/Spersene mud systems are so simple, yet they can do what other muds have tried to do for years

In spite of this simplicity, XP-20/Spersene muds are unusually stable under high temperatures and high pressures. They have outstanding filtration characteristics. They retard the natural swelling of solids. They have excellent tolerance for contaminants. XP-20/Spersene muds do what other muds have tried to do for years, and at much less cost.

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Esso central repair center makes bow

A CENTRAL automotive repair center which puts all 84 Esso dealers in Buffalo, N. Y., in the repair business was opened last week by Esso Standard, Eastern Region of Humble Oil & Refining Co.

The experimental center is believed to be the first of its type in the industry. A second one will be opened in the near future at another location to broaden the base of the test operation.

The center will receive repair orders only through Esso stations. It will charge a wholesale price to which the dealer will add his normal profit. The center will supplement any repair services that a dealer may already offer, and will enable the dealer with none of these services to compete for repair business.

The objectives are to provide a wider range of service to customers and another source of income for dealers. Esso hopes to strengthen its dealers against competition, bolster their profits, and thereby reduce dealer turnover.

Repair bills may be charged on Esso credit cards.

Olin deal lets Humble sell more gas locally

AN INTRASTATE gas market, Humble Oil & Refining Co. hinted last week, is the principal reason for its $68 million deal to acquire Olin Oil & Gas Corp. (OGJ Nov. 20, p. 139).

Olin owns a 1,284-mile gas pipeline. Too, it is the sole supplier of gas to Humble's huge Baton Rouge refinery.

Humble owns major gas reserves in Louisiana and is a major supplier of Olin's line. Humble production for one leg of the three-pronged Olin line comes from such South Louisiana fields as Pecan Island, North Crowley, North Tepetate, and Krotz Springs.

"Olin's pipeline system serves the rapidly growing industrial complex along the Mississippi River between Baton Rouge and New Orleans," said Humble President Morgan J. Davis. "There will be need for increased gas supplies to serve this area, and Humble hopes to participate in serving this need."

Humble has sought through the years to market its natural gas to intrastate customers and thus escape regulation by the Federal Power Commission. Olin's lines to South Louisiana and the coastal area do not cross state lines.

However, its line from the Monroe, La., area moves into, and out of, southwestern Mississippi and, to this extent, is interstate in its operations.

The Humble and Olin boards have agreed to a stock-exchange plan giving Humble all of Olin's assets. Olin stockholders must yet vote on the plan.

Storm-battered rig towed in for repairs

OFFSHORE Co.'s Rig 55, a $4-million drilling barge, will be towed back to a Louisiana shipyard for repair of damages inflicted by the 200-mile-an-hour winds of Hurricane Hattie.

By coincidence, the rig beached itself on a reef northeast of Belize, British Honduras, close to Offshore Co.'s Rig 58, which had been drilling in offshore British Honduras for Phillips Petroleum Co. and which suffered a collapsed derrick during the hurricane.

Rig 58 remained intact at its drillsite, 30 miles south of Belize and 8 miles offshore, and the company said it could be repaired on location. Its 136-ft. derrick and crown block collapsed and fell partly into the 12-ft.-deep water. Bales, elevators, and the block were being fished out last week.

Rig 58's tender, the OV-2, rode out the storm with five men aboard. It was blown onto a reef and suffered minor damage, but is now serviceable.

Signal expands site for refinery through Century Oil purchase

PROSPECTS for a new refinery on the West Coast came a step closer when Signal Oil & Gas Co. purchased Century Oil Co. last week.

Century operates a 5,000-bbl. refinery on a 10-acre site adjacent to Signal's burned-out Hancock refinery in Long Beach. The 10-acre Century site expands Signal's holdings in the area to about 100 acres.

There have been repeated reports that Signal would rebuild the Hancock refinery, which burned in a spectacular fire in 1959, but the company has not announced any firm plans for a new plant. Talk is of a plant with 20,000 to 25,000-bbl. capacity. Limited processing is going on at the old plant and the Century units will be run in conjunction with these.

The Century purchase was a cash deal for an undisclosed sum.

Signal also acquired about 40 service stations in the Los Angeles area with the purchase.

Huron Pipelines plans new products system in southern Alberta

A 600-MILE 4-in. to 6⅝-in. products-pipeline system to serve towns in Central and southern Alberta has been proposed by Huron Pipelines, Ltd.

Huron has applied to the Alberta Department of Mines and Minerals for authority to construct the line. It would cost $10,500,000 and would be in operation by Sept. 15, 1962.

Initial capacity, supplied by Edmonton, Bowden, and Calgary refineries, would be 8,000 bbl. per day. Communities to be served include Edmonton, Wetaskawin, Ponoka, Red Deer, Bowden, Olds, Calgary, High River, Granum, and Lethbridge. Approximately 320 miles of 4-in. to 6⅝-in. line would run from Edmonton to Calgary and another 115 miles of 4-in. from Ponoka to Hughendon where underground storage is available.

ENI girds for marketing drive in Britain

Plans call for 70 fancy outlets at first. Operations of a British subsidiary of the Italian firm will then be steered by a topflight restaurateur.

ITALY'S ENI plans a grand entrance into the United Kingdom gasoline market, through its subsidiary Agip, with a string of fancy service stations that will compete for customers on the basis of quality and price.

Target date for opening of the first outlets has not been disclosed. But groundwork operations have moved into high gear with the appointment of a well-known British businessman as chairman of the local subsidiary of Agip. He is Charles Forte, known as the "Catering King."

The latter title may appear to be an unlikely recommendation for the man spearheading a drive into one of Europe's biggest gasoline markets—and one of its toughest. But Forte has a reputation for savvy and ability in the local business world. He is a specialist in snack bars and restaurants, which will play a big role in the type of outlet Agip plans on building.

Forte, a close personal friend and fishing-trip companion of Enrico Mattei, head of ENI, says Agip is interested in 70 sites initially. Six of these have been tied down. The rest are being negotiated.

Gasoline will be marketed under the "Agip" tradename. Agip's marketing policy will be to offer a top-quality product and the best possible service at the lowest cost "consistent with good marketing and good economics."

Forte says flatly that products made from Russian crude will not be sold in England.

ENI is making no secret of the fact it intends to seek a large slice of the UK market. Starting in the London and Manchester areas, the agency plans eventually to move into all corners of the kingdom.

Two British banking houses, Warburg and Hambros, are represented on the Agip board. Agip would later like to float a public stock issue to bring private investors into its operations.

Charles Forte
. . . won't sell Russian products.

Among the newcomer's immediate problems are lack of an import terminal. Eventually the company may build a refinery, and the possibility may already be under consideration.

ENI is the latest of a series of entrants to the UK gasoline market, where sales this year are up 8% over the demand of 185,000 bbl. daily last year. The French-based Total now has about 100 outlets since its entry a year ago. Continental Oil acquired 400 outlets this year with its purchase of Jet Petroleum. Murphy Corp. is also entering the field.

Total is the trademark of Cie. Francaise des Petroles (CFP). Its marketing company, Total Oil Products (G.B.), Ltd., opened an outlet in London last December. Six months later it had 50 service stations around London and Manchester and has been moving to other areas.

The French were the first to try a U. S.-type service station in the British market. Total puts lots of emphasis on service to the customer.

Ohio plans second European refinery

OHIO OIL will move a large portion of its Libyan crude supplies into West Germany for use in a 40,000-bbl. refinery it will build jointly with a German partner.

Ohio's subsidiary, Marathon International, will have 40% interest in the project to be built at Mannheim under an agreement reached with Wintershall AG. Wintershall, which will hold the remaining 60%, is a domestic crude producer and refiner and holds a substantial interest in B.V.-Aral, one of Germany's biggest marketing organizations. Wintershall also is the largest producer of potash in the country.

The proposed site for the plant is on the Isle of Friesenheim in the Rhine River opposite the Badische Anilin & Sodafabrik, AG, chemical works at Ludwigshafen. Construction will start as soon as engineering design is completed. The plant is expected to be in operation by spring 1964. A joint company, Erdoelraffinerie Mannheim G.m.b.H., has been formed to operate it.

In addition to the usual range of products, the refinery will be designed for a high yield of refinery gas. Ohio is also planning to build a 25,000-bbl. refinery on the north coast of Spain.

The companies expect to bring in crude supplies through a feeder from the Marseille-Karlsruhe pipeline, in which Wintershall is a participant. The crude will be drawn from Libya, where Ohio has one-third interest in a pipeline system that will start moving oil from Dahra field to the Mediterranean coast by mid-1962.

Japanese firms seek government protection

New oil law is being drafted to replace present import controls. Local companies want guaranteed market for crude and curbs on gasoline production.

THE JAPANESE oil industry is choosing up sides over a new oil law that will go into effect when controls on oil imports are removed next year.

Terms of the new law still are under study. But the purpose of the bill will be to exercise some control over supply and demand and offer protection to Japanese crude producers when reins on imports are completely removed in October 1962.

Local companies with international affiliations are in one camp opposing controls of any kind. Lining up in opposition are small refiners and marketers who want a law that will prevent overproduction of gasoline, which they believe would lead to fatal price wars.

Japanese crude producers also are seeking guarantees that room will be made in Japan for their crude production in North Sumatra and the Persian Gulf, as well as from local fields.

At stake is the future role of individual companies in one of the world's fastest growing markets. Under existing controls through the controversial foreign-exchange-allocation system, imports of crude and products have risen from 69,000 bbl. daily in 1950 to 760,000 bbl. daily this year.

In anticipation of severe competition and confusion when controls are removed, companies in Japan this year are spending $306 million on refining and marketing facilities. The purpose is to have as much of the market as possible when complete liberalization of imports arrives.

But there are growing fears on the part of small refiners of an inevitable over-supply of gasoline in a completely free market. This is because gasoline accounts for only 20% of demand. while fuel oil takes 60%. In the past, foreign-exchange allocation was rigged to limit crude imports to meet gasoline demand.

Under this policy, gasoline yield of crude determined crude imports. The shortage of fuel oil was made up with fuel-oil imports. The government recently, however, has permitted purchase of more crude than needed to meet gasoline demand. This was done in anticipation of complete removal of controls next year. The result has been an oversupply of gasoline and declining prices (OGJ, Aug. 28, p. 62).

Crude interests. The new law also will be expected in some way to insure a market for Japanese-controlled crude output. Teikoku Oil and Japan Petroleum Exploration Co. currently produce about 13,000 bbl. daily in Japan. Arabian Oil Co. produces 30,000 bbl. daily from Khafji offshore field in the Persian Gulf, off the Neutral Zone. It hopes to produce and sell 170,000 bbl. daily by 1964. North Sumatra Oil Development Cooperation Co. (NSODC) by 1964 will be bringing in 12,000 bbl. daily from Indonesia.

At present, Japanese refiners take Arabian Oil crude on a prorated basis at an f.o.b. price of $1.42 per bbl. less a 16-cent discount. Importers are not directly compelled to take the crude. But they get a special exchange allocation for Khafji oil which cannot be used for any other crude. Arabian Oil, however, has no assurance of outlets under the forthcoming liberalization.

Companies with crude in Japan and North Sumatra are worried about price competition. Domestic crude currently is priced from $3.10 to $3.50 per bbl. The latest laid-down cost of crude from Kuwait, in contrast, is $2.18 per bbl. And Kuwait crude accounts for a full third of all crude imports.

A price of $2.13 f.o.b. Pangkalansusu, North Sumatra, has been set for crude being developed jointly by Permina, of Indonesia, and NSODC. The crude will be brought to Japan as repayment in kind of a $52.3-million credit to be provided over 10 years. Despite a claim that this crude contains 60% gasoline, 15% kerosine, and 10% gas oil, the price is high compared with an over-all average f.o.b. price of $1.48 for crude brought into Japan.

Japan will get Lomax unit

Process will be installed as part of expansion at Mizushima plant. It's to be first of its kind in nation.

MITSUBISHI Oil plans to add 10,000 bbl. capacity and considerable flexibility at its new 40,000-bbl. Mizushima refinery.

The Japanese company, owned 49% by Tidewater, will spend $27 million for the additional facilities. These will enable the plant to process low-quality crude, such as from Wafra field in the Neutral Zone, without difficulty, and to adjust gasoline and middle-distillate yields to meet market demand.

New units, in addition to a 10,000-bbl. still, will be an 8,700-bbl. Unifining-Platforming unit; a 2,500-bbl., middle-distillate Unifiner; a 9,500-bbl. Lomax unit; a 17,200-M.c.f. daily hydrogen unit; and a 64-tons-per-day sulfur-recovery unit.

The Lomax unit will be the first ever built in Japan, and the second in the world. Mitsubishi chose the process because of its flexibility in varying the product yield of white oils. Since a gasoline surplus is a headache to the local industry, and because kerosine and gas oil are in relatively short supply, especially in winter, the Lomax unit will be used to minimize gasoline yield.

The hydrogen unit will be the first of its kind in Japan. Light ends from various units will be fed into the plant, where hydrocarbons will be steam cracked into hydrogen and CO under the presence of nickel-based catalyst. The hydrogen will be supplied to the Unifining and Lomax units.

The second stage is scheduled for

completion in May 1963. A petrochemical project will open at the refinery in 1964, and will be supplied with 2,900 bbl. daily of virgin naphtha from the refinery. It will have a capacity of 43,100 tons per year of ethylene, 332,000 tons of propylene, 63,200 tons of acetaldehyde, 15,000 tons of acetone, 7,200 tons of acrylonitrile, and 6,000 tons of octanol.

Socal, Shell suspend Bolivian exploration after five dry holes

CALIFORNIA Standard and Royal Dutch-Shell have suspended drilling operations in Bolivia after a 4-year $20 million program in which five dry holes were drilled.

The operating subsidiaries, Bolivia California Petroleum Co. and Cia. Petrolera Boliviana Shell, Ltd., told the government they were calling off drilling operations because of "disappointing results."

Three of the wildcats were abandoned this year. Santa Rosa 1, given up in January, and Montecristo 1, abandoned in October, both were bottomed below 11,300 ft. Monteverde 1, abandoned in August, was bottomed at 15,297 ft.

Shallow Cebu tests slated

A LOCAL Philippines company plans to drill 15 shallow wells next year in an effort to evaluate a shallow discovery on the northern tip of Cebu Island.

The firm, American Asiatic Oil Corp., has acquired a rig to drill the tests. Each will be to a minimum of 1,200 ft. and in the vicinity of its DST-1 find, which came in last March. The well's best performance was 144 bbl. daily on a test with a ¾-in. choke. The 46°-gravity, low-sulfur crude was from a shallow pay between 238-243 ft. A stepout well, MST-11, tested 56 bbl. daily from similar depths, but had shows down to 990 ft.

On the basis of stratigraphic drilling, the company estimates the structure to be ¾ mile wide and 3½ miles long.

While American Asiatic retains 100% interest in the license area on which the find is located, the company has farmed out part interest in other licenses in the area to affiliates of Jersey Standard and Mobil International. Each of the latter companies holds 25% interest in areas of joint agreement. No drilling is in progress at present on these areas.

Foreign briefs

Russia has spudded a "super-deep" wildcat in the desert between the Caspian and Aral seas. The test, projected to 6,000 meters (19,680 ft.) on Mangishlak Peninsula, will probe for oil and gas between two of the country's oldest producing regions. These are the Guriev region to the north, and the Turkmenian coastal fields, including Cheleken, to the south.

A 112-mile natural gas pipeline from the Sarajeh field to Tehran will be built by National Iranian Oil Co.

First deliveries will begin in December through Venezuelan Petroleum Corp.'s 75-mile natural-gas pipeline from Caigua to La Fria, in western Venezuela. The line will move 10,000 M.c.f. daily from West Tarra field. First customer will be an electric utility. The government plans to build a 50-mile extension to San Cristobal.

Construction will start early in 1962 on a 2,700-bbl. lubricating-oil plant to be built at Texaco's 235,000-bbl. refinery at Point-a-Pierre, Trinidad. An early phase of the work will be construction of deep-water facilities to handle special tankers which will carry lubricating-oil stocks to the company's foreign markets for blending and compounding. Blending and packaging facilities will be included in the facilities to provide finished motor oils in the West Indies and Caribbean. The plant will be completed in 1964.

Purchase of 14% interest in Great Plains Development Co. of Canada, an oil and gas exploration and production company, was announced by Burmah Oil Co. In addition to 200,000 shares purchased at $15 per share. Burmah Oil also has an option on another 300,000 shares, which would give it about 30% interest in the company.

BP's new refinery in northern Ireland will supply 50 tons of refinery gases a day to the Belfast Corp. Gas Committee. The supply will fill from one-quarter to one-third of Belfast's gas requirements. The 26,000-bbl. BP plant goes on stream in 1963.

Contract for expansion of Syriam refinery has been awarded to Foster Wheeler, Ltd., London, by Burma Oil (1954), Ltd. A new 14,300-bbl. distillation unit will raise capacity of the plant to 19,500 bbl. The $8.4-million project will be completed by July 1963.

FLOATING drilling barge, Venmac III, recently was equipped with a production-type platform to increase its ability to make ocean-floor completions.

Ocean-floor completions

How the first in U. S. tidelands was designed off California

BY CARL LAWRENCE
West Coast editor

OFFSHORE DRILLING took a new dimension recently when the first well was completed on the ocean floor off California.

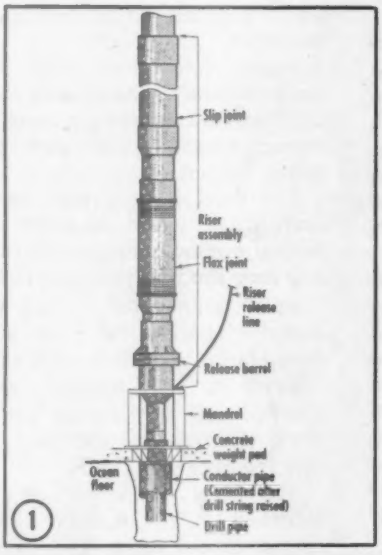
Western Offshore Drilling & Exploration Co., the Long Beach contractor that made this first subsea completion in the U. S., has done several jobs off California in recent months and has developed a five-step technique in drilling and completing a well under water.

Western Offshore had made the California completions for Richfield Oil Corp., the Los Angeles firm that pioneered ocean-floor completions off Peru along with Cities Service Co. The two companies are partners in Peruvian Pacific Petroleum Co., the firm which made the first deep-water completion in the open sea last fall (OGJ, Oct. 3, 1960, p. 65).

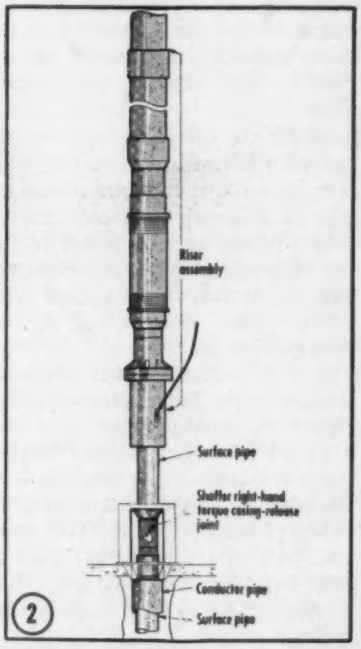
In the year since the Peruvian completion, the technique has moved into the tidelands off California. The first completion in domestic waters was made last March for Richfield off Rincon Point (OGJ Newsletter, Mar. 13). Western Offshore was contractor on this job.

How it's done. Details of how Richfield completed the well off Rincon have never been divulged, however, Western Offshore has developed its own techniques for shallow-water subsea completions. The Western Offshore technique is discussed here.

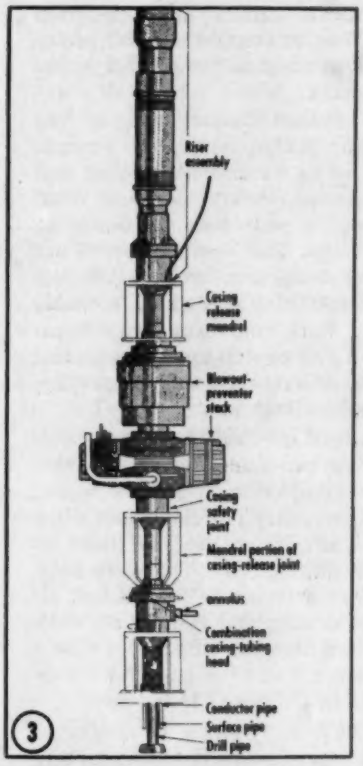
5 steps in an ocean-floor completion



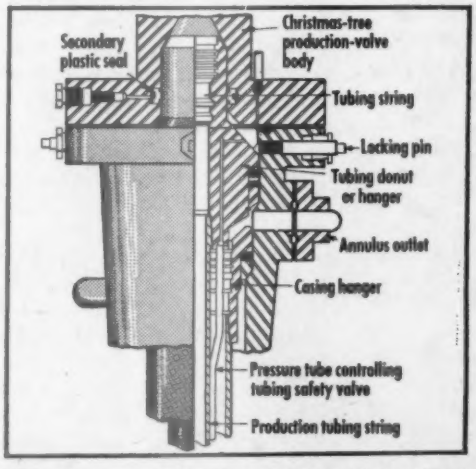
SURFACE HOLE is drilled and conductor pipe cemented in top portion of hole in ocean floor.



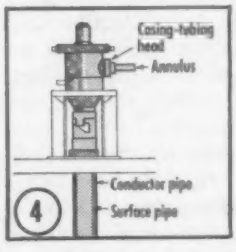
SURFACE STRING is set and the riser assembly returned to the drilling barge.



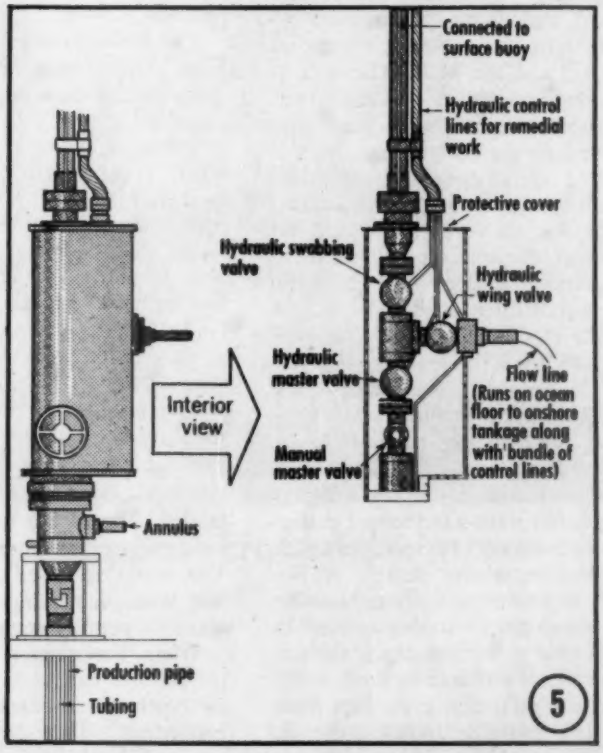
BLOWOUT PREVENTERS and casing-tubing head made up on surface pipe. Hole is drilled to TD.



KEY piece of equipment is casing-tubing head. Production and tubing strings are landed in head. It holds BOP during drilling, christmas tree on completion.



ONLY the special casing-tubing head remains on the ocean floor once drilling has been completed.



CHRISTMAS TREE enclosed in protective cover is connected to casing-tubing head. Marker buoy installed and well ready for flow line to onshore tankage.

The method developed by the contractor carries the well from spudding to completion with provisions to reenter the well for remedial work.

Western Offshore uses its big floating drilling barge, the Venmac III, for its ocean-floor drilling and completion work. Drilling is done through a well near the center of the barge. The Venmac moved out of dry dock recently after a production-type cellar was added to enable faster work on subsea completions. A heliport to step up the movement of the drilling crew and some equipment also was added.

Divers are used by Western Offshore at two points during an ocean-floor completion in shallow water. However, they are eliminated when the water is too deep for them to work satisfactorily. The work done in shallow water is limited and all other drilling and completion work is done from the barge.

Here's a step-by-step rundown on Western Offshore's technique:

STEP 1. A string of conductor pipe is hung below the rotary table to within a few feet of the ocean floor. The drill string is made up of an expanding - type hole opener, drill collars, enough bumper subs to compensate for wave action, more drill collars, and the kelly. The hole is spudded and drilled with salt water.

Once enough hole is made and opened to the correct size, mud is spotted and the drill string raised to where only enough to serve as a guide for the conductor pipe remains in the hole. The conductor is run and cemented and the drill string pulled out of the hole.

The top joint of conductor pipe is made up on the mandrel of a casing-release joint. The ocean - floor assembly also includes a landing base and a weight pad which are locked to the mandrel.

A riser assembly is connected to the Shaffer right-hand torque casing-release mandrel with a special inside or outside release barrel. A flex joint above the release barrel handles any unnecessary strains caused by horizontal movement at the surface, and vertical movements are handled by a slip joint above the flex joint. Enough casing is run above the slip joint to provide a pitcher nipple to the mud-return system on the barge.

Drilling resumes, with mud being used as fluid, and enough hole is made to run surface pipe to the ocean floor.

STEP 2. With the surface hole completed and the drill string removed, surface pipe is run. Enough surface pipe is run so that some remains in the conductor when the riser assembly is released at the Shaffer right-hand casing release joint.

STEP 3. Once the riser is removed, the rest of the surface pipe is made up. The top joint of surface pipe is made up in a combination casing-tubing head. Flanged to the top of the head is the mandrel portion of another Shaffer right-hand casing-release joint, which is surface-pipe size.

The blowout-preventer stack is flanged to the barrel portion of the right-hand casing-release joint and a right-hand casing-release mandrel the same size as the one used on the conductor pipe is torque locked to top of the BOP stack. This setup enables the riser assembly used in Step 1 to be reconnected, providing a mud-return system back to the barge.

Once the annulus between the conductor and surface pipe is cemented, then drilling to total depth proceeds.

The casing-tubing head is the key piece of equipment in Western Offshore's ocean-floor completion technique.

The head has an upper and lower bowl. The production string is landed in the lower bowl; the tubing in the upper. The bowls are protected during drilling by a retrievable protector, which is removed just before the production string is landed.

Here's how the two strings are connected:

The production string is landed with a mandrel-type hanger and packer. It has a course, acme-type, left-hand thread for release once landed. The casing string is run in until the hanger lands in the bowl. The string is raised 2 or 3 ft. so that while cementing the hanger is up. This permits annulus returns.

When the cement job is completed, the hanger is lowered into its bowl and the left-hand thread backed off. The string is cleaned out and the head is ready for the tubing.

The tubing string is landed by running the tubing on the mandrel. Once the string is in the bowl, a diver tightens the locking pins and tests the hanger seal. Once the seal is tested, a tubing plug is run and tested. The only other job performed by the diver on this trip is to disconnect the flanges. As the flanges are disconnected, the tubing which extends from the hanger back to the barge is backed off, pulled, and laid down.

A downhole tubing safety valve can be included in the head's make-up. The valve would be controlled through a small pipe and port in the tubing hanger.

The head is built with enough strength to support the BOP stack during drilling and the christmas tree once the well is on production.

STEP 4. Once the well has been drilled, everything above the casing-tubing head is returned to the barge.

STEP 5. The christmas tree is now lowered to the floor with its connecting flow line, the buoy guide tube, and operating lines.

The diver submerges with the christmas tree to connect it with the casing - tubing head. The primary tubing seal is made by the diver when he tightens the plastic packing screw. The annulus between the tubing and production string is packed off by the hanger seals. The seal ring in the flange is a secondary seal and provides for controlled pressure from the operating tube above to be directed into the port in the tubing hanger, and on down to the tubing safety valve if one is used.

The christmas tree is enclosed in a liquid-tight container filled with oil to protect the equipment from corrosion and sea life. There are two master valves: one with hydraulic controls and the other with manual controls. Both the wing valve controlling flow into the production line and the swabbing valve are hydraulically controlled.

Two sets of hydraulic lines run from the christmas tree. One goes to a marker buoy and the other runs along the production flow line to shore. The lines to the marker buoy are used when servicing the well and the lines to shore actually control the well.

The marker buoy at the surface is connected to the receiver spool which is flanged to the top of the swabbing valve on the christmas tree. The spool has a throat in which

a latch sub will seat and attach itself as well as providing a seal between the sub and spool. The latch sub is run on the bottom of a short string of tubing which provides a lubricator back to the barge.

Once the christmas tree is in place, the buoy work completed, and flow and control lines run to shore, the well is ready to go on production.

Remedial work. The buoy connections designed by Western Offshore make it possible to service the well from the surface in either a service boat or a barge.

A lubricator or swabbing string with a latch sub on the bottom can be run down the guide tube and into the seat of the receiving spool. Once the string is tested, the swabbing valve can be opened and closed from the surface and tools run into the well. When the work is completed, the swabbing valve can be closed, the tools retrieved, and the well put back on production.

The technology which led to the development of Western Offshore's ocean-floor completion method actually predates the company.

Ross A. McClintock, vice president and general manager for the firm, obtained patents on the technique in 1954 when he was sales engineer for Shaffer Tool Works, Brea, Calif.

McClintock joined with Howel Haney and Stan Williams of Haney-Williams Drilling Corp. to organize Western Offshore in 1957.

The future. The various types of ocean-floor completions being made today off California are the beginning of what may become standard operating procedure for offshore operators, particularly those off California.

Four companies have made or are attempting ocean-floor completions of some type off California, and many others are expected to adopt this new drilling method. One subsea completion has been reported in the Gulf of Mexico off Louisiana, but no details have been released.

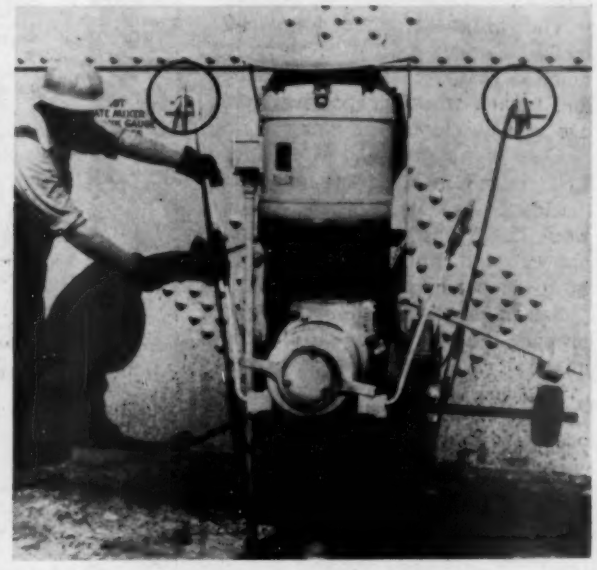
Two big advantages of this new technique are:

1. Cheaper completion costs since no production platform is needed. All wells can be drilled as straight hole, saving material and drilling time.

2. Opening areas where platforms are prohibited. This is especially true off California where some beach communities have drilling bans since they feel platforms will destroy the beauty of the area. And in other areas platforms are considered navigational hazards.

Deep water also poses no barriers. Two of the completions made off California are in water over 200 ft. deep.

This new method also may permit some areas in shallow water to be drilled. This was the case off Peru. The pay zone was too shallow to be reached by a whipstocked well from onshore and building a platform couldn't be justified economically. The result was a well drilled and completed on the ocean floor from a drilling barge.



Adhesive-attached plates . . . support crude-tank mixer

STEEL PLATES, like the one shown here, were required on the side of a crude-oil feed tank to support a mixer that was needed in a hurry. Welding would mean a lot of down time to drain the tank, or fill it with water, to prevent fire or explosion. Shell Oil Co. engineers decided to try a Shell-developed adhesive, Epon Adhesive 901/B-1. Both metal surfaces were prepared by sandblasting to bright metal, and a ⅛-in. layer of prepared adhesive was applied to both surfaces. The plates were put in place and supported while the adhesive set up.

Next day, J-bars were attached to the plates and the mixer frame, and full load of the mixer was put on the tank wall. Down time was less than 4 hours, as the connection through the manhole was made when fluid level in the tank was low, and tank was returned to service as soon as the manhole was sealed again. After 6 months of operation, there is no sign of failure in the bonded joint, despite the continual load of 1,250 lb.

Frozen holes provide LNG storage

With new technique it is technically possible and economically feasible to store liquid natural gas in frozen-earth cavities. It promises, its backers say, to lift LNG from the experimental to the commercial

BY H. C. BOZEMAN
Gulf Coast Refining Editor

LIQUID NATURAL GAS is ready to go commercial. The last step, inexpensive storage, is now complete and LNG can set about conquering gas markets in natural gas-poor countries and in peak shaving.

Underground storage of LNG in frozen earthern cavities has proved feasible technically and, the supporters say, economically. Underground storage promises to lift LNG from the experimental to the commercial.

The promised surge for LNG could be compared to the surge in demand that occurred for propane and butane when inexpensive storage was developed for them.

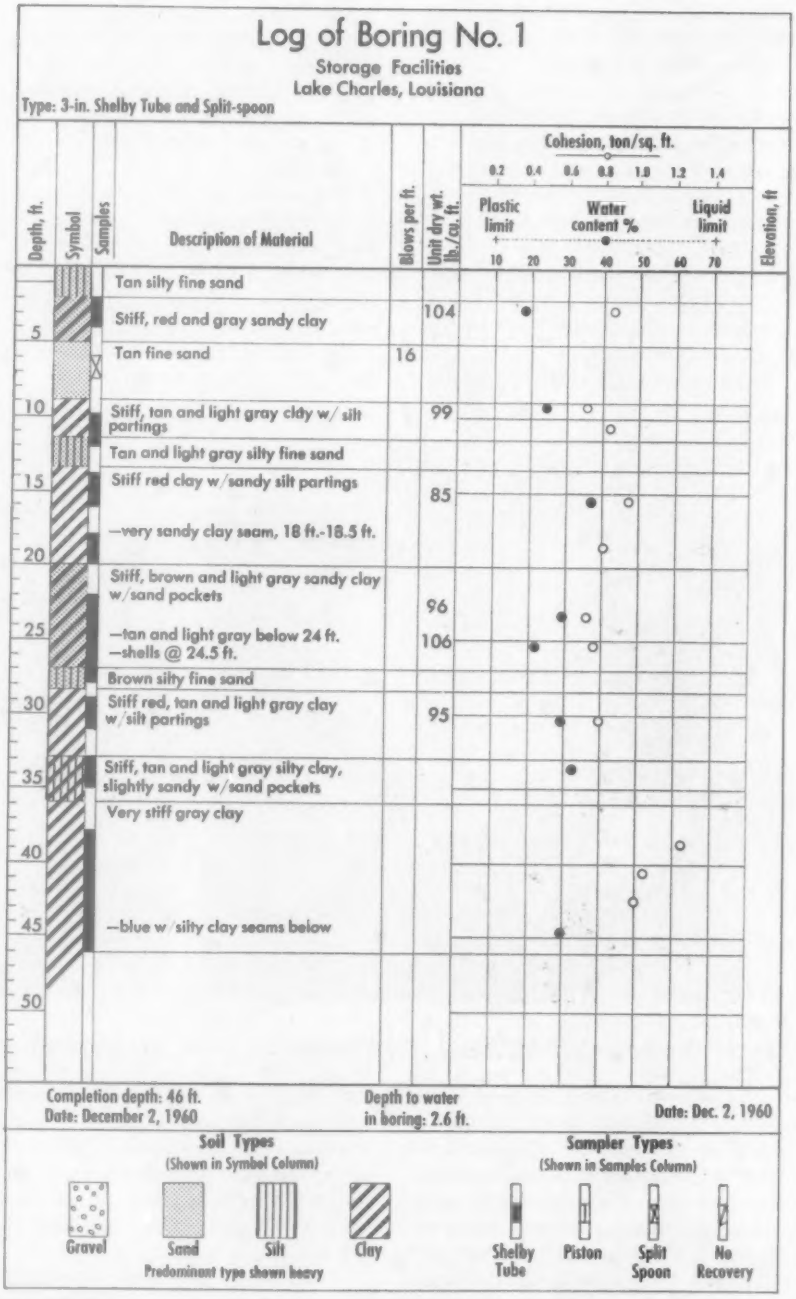
Cost of underground storage of LNG in frozen holes has not been disclosed, but its backers say it would be "substantially less" than aboveground storage which is about $6 to $8 per barrel of capacity.

Salt-dome storage of butane and propane is about $1 per barrel while mined storage is about $4 per barrel.

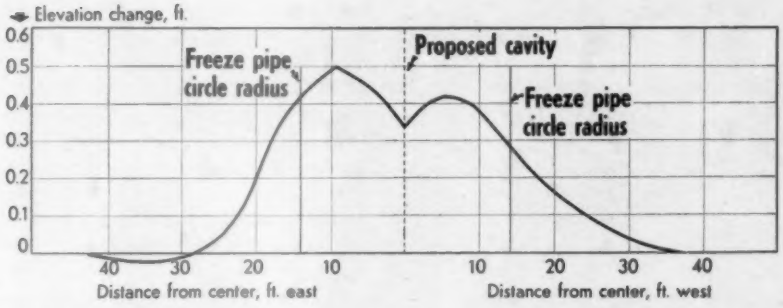
Last month Conch International Methane, Ltd., and Constock Pritchard Corp. demonstrated their "frozen earth" technique for storing LNG at a site near Lake Charles, La.[1] This report presents some details of the experiment.

The problems. The underground-storage experiments benefited from the technology and know-how developed in previous work with LNG in the areas of liquefaction, transportation and handling, and storage.

However, before the experiment could begin, answers were needed to problems in heat transfer, soil mechanics, and frost heaving of the proposed frozen-earth storage hole. Conch and its consultants probed



TEST BORING revealed that test site contained variety of sand, clay, and silt-type soils. Fig. 1.



MAXIMUM GROUND HEAVE during prefreezing occurred inside the freeze-pipe circle. Fig. 2.

the problems in theoretical and laboratory studies. Results were favorable and the prototype experiment was undertaken.

Background

Conch recognized that safe, dependable, and economically feasible storage for LNG was needed before it could become commercial. Any developments that further enhance the safety of storing large quantities of LNG would surely hasten acceptance of LNG installations. With increased safety, Conch expects the relaxation of penalizing tank-spacing requirements.

Underground storage can lower costs in at least two ways compared to aboveground storage. First, the container costs less. Second, the area required for the same storage capacity is less because no diking is required.

Conch initiated in 1960 a research project to investigate this new concept of low-temperature storage in frozen-earth holes.

A preliminary small-scale test with liquid ethylene at Shell Research in England encouraged Conch to proceed with construction of the prototype which would prove the theoretical data and provide actual experience. A test location near Lake Charles, La., was selected and the project was nicknamed "Operation Mudpie."

The project was based on an idea of Dr. C. M. Sliepcevich, consulting chemical engineer, University of Oklahoma. Heat-transfer studies were conducted by Dr. S. W. Churchill, of University of Michigan. Frost heaving and frozen-ground problems were investigated by Dr. Fred Sanger, of Hanover, N. H. Research centers of Continental Oil Co. at Ponca City, and Shell Research, Ltd., at Thornton, England, did many preparatory analyses. Constock Pritchard Corp. supervised construction of the entire test facility.

Soil Properties

Storage concept was to fill an uninsulated frozen-earth hole or cavity capped by an aluminum roof with LNG at — 258° F.

Success depended upon the frozen earth forming an impermeable barrier. Soil properties would play a crucial role. McClelland Engineers, Houston, made borings at the proposed test site, Fig. 1. Test borings stopped at the 46-ft. depth.

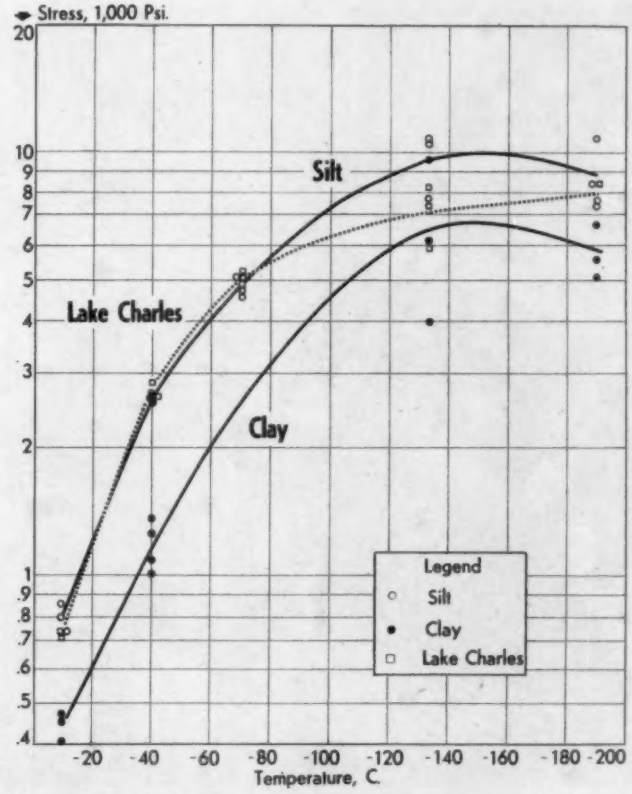
The test site contains several layers of silty soil which are reported to be of the frost-heaving type. In fact, during prefreeze operations maximum vertical heave was 0.5 ft., Fig. 2. Heaving should stabilize when temperature isotherms stop moving outward from the hole.

Strength of frozen soil increases with a decrease in temperature, Fig. 3. Tensile, compressive, and shear strengths all show similar characteristics. All three are important even though the container's walls are in compression.

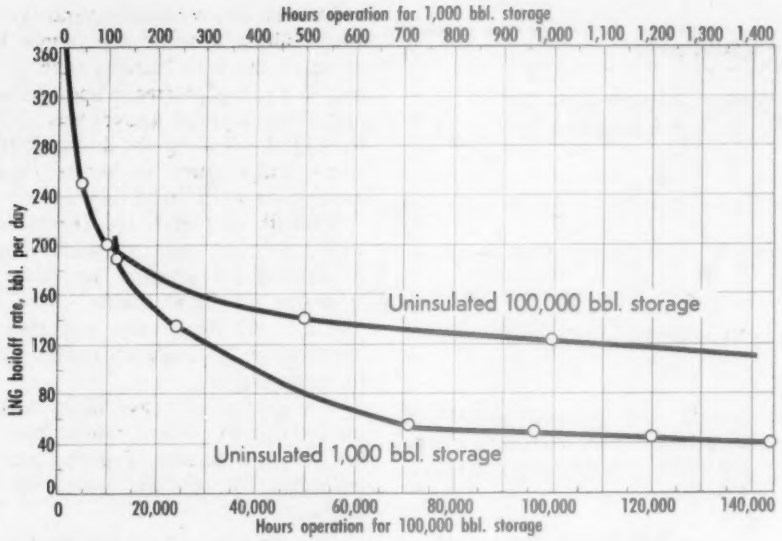
The amount of heave varies with the soil's water content, rate of freezing, and other factors. Freezing temperatures for soil are lower than for water.

Soil can freeze at any temperature but at the test site freezing was calculated to occur at 27° F. Some clays require temperatures as low as —150° C. to freeze all the water.

Crack propagation of frozen soils can't be predicted and could be a problem but wasn't at the test site. Frozen soils also exhibit a viscoplastic property which should help to close cracks and frost heaving would help in this respect.



COMPRESSIVE STRENGTHS of frozen clay, silt, and Lake Charles soil increase with decrease in temperature. Fig. 3.



BOILOFF RATES of uninsulated 1,000 and 100,000-bbl. underground storage holes. The 1,000-bbl. curve approximates results with 850-bbl. prototype. Fig. 4.

Heat Transfer

Important factors in technical and economic evaluation of LNG underground storage are heat flow rate from the earth to the storage cavity and resulting temperature field.

These factors were investigated for various insulated container configurations including isothermal flat plates, spheres, and cylinders.[2] The studies showed heat transfer fell rapidly with time to a pseudo steady state and later to decrease to zero for a flat plate and cylinder and to a lower steady state for a sphere.

Accumulative heat flow during the initial falling rate period may be a large part of the first year's heat flow. The insulation's thermal diffusivity controls during the initial period where the insulation develops a linear temperature profile and ground temperature remains unchanged. Insulation conductivity controls during the pseudo steady-state period. Finally the ground temperature and heat flux density decrease slowly and thermal resistance of the ground becomes significant.

Heat flow during the initial and pseudo steady-state periods to the insulated underground storage tanks is almost the same as to aboveground tanks with the same insulation. Ground resistance during the final period reduces heat flow below that of an aboveground tank. Heat flow for the underground tank is less because earth resistance is higher than convection and radiation resistance aboveground.

Uninsulated ground storage holes exhibit a high boiloff rate initially, but fall rapidly to more steady-state values, Fig. 4. Insulation can cut the initial loss but will have only a minor influence later.

TARPAULIN PROTECTED frozen ground from solar radiation and erosion by rain. Fig. 5.

Construction

These studies of soil properties and heat transfer showed a good chance of success and the green light was given for actual construction of the prototype.

The 850-bbl. cavity is 20 ft. in diameter by 20 ft. deep with a hemispherical bottom. Construction was divided into four phases: prefreeze, excavation, roof installation, and filling.

Prefreezing was done by circulating propane refrigerant through vertical pipes arranged in a 28-ft.-diameter circle and buried 30 ft. deep.

Excavation began when the frost boundary had moved inward 4 ft. The 20-ft.-diameter unfrozen center was then excavated. Tarpaulin laid over the excavated parts of the cavity protected the frozen ground from melting by solar radiation and from erosion by rain, Fig. 5.

A nonpermeable clay stratum below the hole slowed water seepage into the bottom which remained unfrozen during excavation. Larger-diameter cavities may require some form of dewatering to prevent excessive water seepage into the cavity from lower strata.

HOLE WAS FILLED with LNG when walls and bottom reached preset temperature. Fig. 6.

Thermocouples at several depths in and around the cavity gave temperature-distribution data.

Roof installation was made after excavation. The insulated aluminum roof was sealed to the frozen ground. Conch did not disclose the sealing method. Periodic checks have failed to detect gas leaks. Insulating the ground surface around the freeze pipes minimized the influence of outside heat.

Filling procedure was to minimize thermal shock which could shatter the frozen-earth walls and bottom. Initial spraying with LNG slowly cooled the hole. When the walls and bottom reached preset temperatures the hole was filled with LNG, Fig. 6.

Operation

Conch says the underground-storage cavity has performed as expected. The system presently is operating at 10 in. of water pressure. Boiloff is vented to flare stack.

Ground heaving has presented no problems because most of it occurred during prefreezing. The 0° F. isotherm was about 8 ft. from the cavity sides after 30 days' operation, Fig. 7.

Fitting one-eighth the insulation to the underground - storage cavity will lower normal boiloff losses to the same order expected from the same capacity of aboveground storage tank, Conch says.

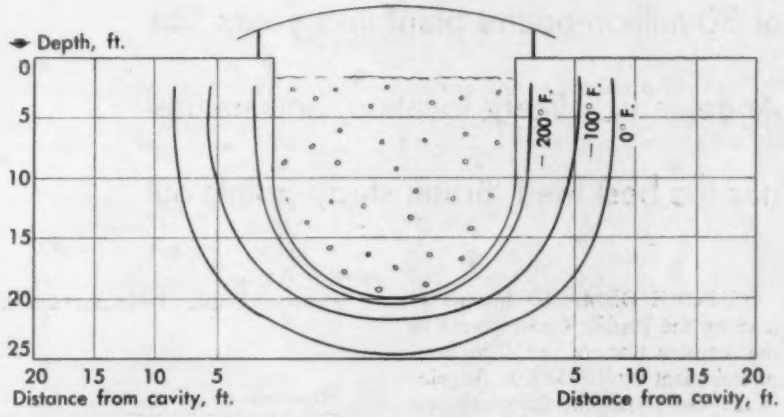
Pumping of LNG from the underground hole uses the vapor-lift system, Fig. 8. The boiling LNG is lifted out of the cavity by applying a vacuum to the discharge end of the lift pipe. A submerged pump in the vapor-liquid separator then has enough NPSH to operate without cavitation.

Vapor losses can be minimized by heat exchanging the compressed vapors with the subcooled liquid discharged from the pump and returning the condensed vapors to the cavity.[3]

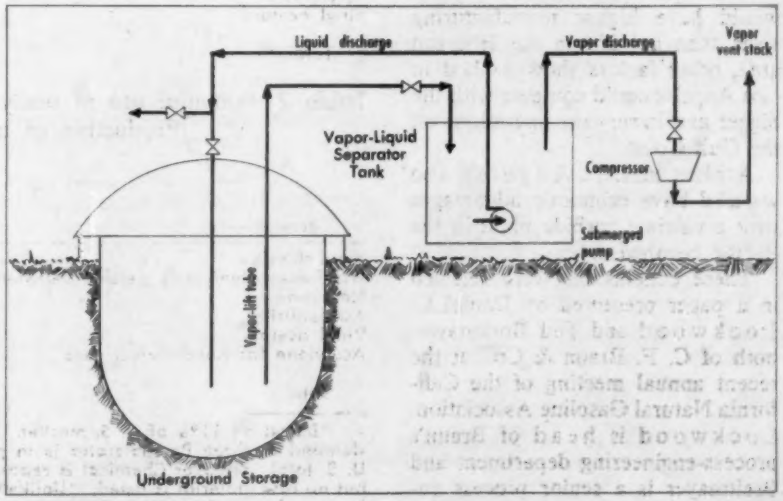
Advantages of the vapor-lift system are that only one system is needed for several cavities and all equipment is placed abovegrade.

References

1. "Hole in the Ground Stores Frigid LNG": The Oil and Gas Journal, Vol. 59, No. 42, p. 60 (Oct. 16, 1961).
2. Churchill, Stuart W., "Heat-Transfer Rates and Temperature Fields for Underground Storage Tanks": presented at SPE meeting, Dallas, Oct. 8-11, 1961.
3. "Coming Up: Commercial Transport of LNG": The Oil and Gas Journal, Vol. 59, No. 41, p. 123 (Oct. 9, 1961).



GROUND-TEMPERATURE ISOTHERMS were determined after 30 days' operation. Fig. 7.



VAPOR-LIFT SYSTEM was designed so that no mechanical equipment needed to be located in the cavity. Fig. 8.

WHAT'S AHEAD FOR ACETYLENE on the Pacific Coast?

Market forecast points to the possibility of 30-million-pound plant in 5 years. Los Angeles is a likely location, and natural gas the best feed, Braun study points out

FUTURE DEMAND for acetylene on the Pacific Coast points to the construction of a 30-million-pound plant by 1965. Los Angeles is the likely spot for the plant and the hydrocarbon route is favored over a calcium carbide plant.

Although a Los Angeles plant would have higher manufacturing costs than a plant in the Houston area, other factors show a plant in Los Angeles could compete with the bigger and lower-cost operations on the Gulf Coast.

A plant in Los Angeles also would have economic advantages over a calcium carbide plant in the Pacific Northwest.

These conclusions were reached in a paper presented by Daniel C. Lockwood and Ted Breitmayer, both of C. F. Braun & Co., at the recent annual meeting of the California Natural Gasoline Association. Lockwood is head of Braun's process-engineering department and Breitmayer is a senior process engineer.

The projections made by Lockwood and Breitmayer are based on a 1965 acetylene demand of 60 million pounds annually. This demand is tied to the predicted growth of vinyl chloride.

U. S. production of vinyl chloride is expected to reach 1,110,000,000 lb. by 1965. Since vinyl chloride production is the principal chemical use of acetylene, it seems reasonable to assume the 1965 use of acetylene will go up in about the same ratio as vinyl chloride. On this basis, the 1965 use of acetylene on the Pacific Coast should be 62 million pounds, but this can be rounded back to 60 million since not all uses will grow as fast as vinyl chloride.

Acetylene capacity on the Pacific Coast today is 26 million pounds annually.[2] This means some 34 million pounds of new capacity could be required by 1965. However, the present reported capacity for producing calcium carbide on the Pacific Coast is 52,000 short tons per

Table 1—Important chemical uses of acetylene

Chemical—	Est. U. S. prod. in 1960, M.M. lb.	Per cent from acetylene	Est. U. S. acetylene requirement in 1960, M.M. lb.
Vinyl chloride	925	60	255
Trichloroethylene and perchloroethylene	595	60	90
Neoprene	250	100	175
Acrylonitrile	250	80	120
Vinyl acetate	230	80	55
Total	...	...	695

Table 2—Potential use of acetylene on the Pacific Coast in 1960. (Production of acetylene derivatives)

Chemical—	U. S. prod. from acetylene, M.M. lb.	Pacific Coast share,* M.M. lb.	Pacific Coast potential use of acetylene, M.M. lb.
Vinyl chloride	555	61	27
Trichloroethylene and perchloroethylene	370	40	†10
Neoprene	250	27	‡0
Acrylonitrile	200	22	§0
Vinyl acetate	185	20	¶6
Acetylene for nonchemical uses	80	9	9
Total	...	...	52

*Based on 11% of U. S. market. This estimate assumes acetylene derivatives demand in three Pacific states is in proportion to population, which is 11% of U. S. total. †Hooker Chemical is reported as making perchloroethylene in Tacoma but no raw material is listed. ‡Unlikely such a plant will be built on Pacific Coast in near future, because only producer has no other facilities in area. §Demand for acrylonitrile too small for economical size plant to be built. ¶Some 10 million pounds of vinyl acetate plant capacity installed on Pacific Coast by 1962.

year, which is equivalent to 35 million pounds of acetylene per year. From this the new acetylene capacity required by 1965 could be as little as 25 million pounds.

Thus, the additional capacity required to meet demands by 1965 could be in the 25 to 34-million-pound range or say 30 million pounds per year.

It is unlikely that plants to produce all the derivatives mentioned in Table 2 would be built on the Pacific Coast. Even in the case of vinyl chloride, where it is likely that an acetylene-based plant will be built, it is unlikely that all the potential coast market could be captured by a coast producer. From considerations such as these it is possible that to satisfy 1965 demands a plant should have a capacity no larger than 20 million pounds.

On the other hand, new acetylene derivatives, on looking to the 1970 market, might justify a plant in the 40-million-pound range. For these reasons three sizes of plants—20, 30, and 40 million pounds—were considered by Lockwood and Breitmayer.

LA vs. Houston. The centers of population on the Pacific Coast—Los Angeles, San Francisco, Portland, and Seattle—are all likely locations for an acetylene plant.

The Los Angeles area has the advantage of being the center of the largest population concentration. Portland and Seattle have the advantage of low-cost electric power.

Looking at Los Angeles, the hydrocarbon route will probably be used if an acetylene plant is built. The calcium carbide process uses about 4.7 kw. of electricity per pound of acetylene product. Electricity costs about 8 mills per kilowatt in Los Angeles. Thus, the carbide route in this area is faced with the almost insurmountable power cost of 4 cents per pound of acetylene.

The economics for an acetylene plant in the Los Angeles area for three plant sizes based on today's costs are given in Table 3. These economics are based on a modern partial-oxidation process using natural gas as the raw material.[3] The investment figures are for a battery-limits plant using purchased oxygen. The required selling price for acetylene assumes a cash flow—profit after taxes plus depreciation — of 25% on investment.

To produce the return used in Table 3, acetylene must sell at from 11 to 14 cents per pound. The big question is: Can acetylene be sold at from 11 to 14 cents per pound in the Los Angeles area?

The answer to this lies in the cost of acetylene derivatives brought in from other areas. Limiting this consideration to domestic production, the Gulf Coast area provides the most likely competition for acetylene derivatives from hydrocarbon acetylene.

Since the cost of acetylene is an important factor in the cost of its derivatives, Table 4 gives the economics for three acetylene plants in the Gulf Coast area. The plant capacities were chosen to match approximately the capacities of three plants recently announced for the Houston area, all using hydrocarbon processes.

Comparing Los Angeles with Houston, it is apparent that there

Table 3—Economics for hydrocarbon acetylene in the Los Angeles area

Plant capacity, lb. per year	20,000,000	30,000,000	40,000,000
Investment	$3,100,000	$4,100,000	$5,000,000
	Cents per pound of acetylene		
Raw materials:			
Natural gas, at 35 cents/M.M. B.t.u.	3.50	3.50	3.50
Oxygen, at $7.70 to $9 per ton	2.41	2.23	2.06
Operating labor, at $3/hr.	0.53	0.33	0.26
Maintenance, at 3% of investment	0.47	0.41	0.37
Utilities:			
Power, at 8 mills/kw.-hr.	0.32	0.32	0.32
Steam, at 60 cents/1,000 lb.	0.10	0.10	0.10
Cooling water, at 2 cents/1,000 gal.	0.27	0.27	0.27
Process water, at 15 cents/1,000 gal.	0.05	0.05	0.05
Chemicals	0.07	0.07	0.07
Royalty	0.30	0.30	0.30
Total direct costs	8.02	7.58	7.30
Less fuel-gas credit, 35 cents/M.M. B.t.u.	1.78	1.78	1.78
Net direct costs	6.24	5.80	5.52
Prorated costs, 140% operating labor plus half-maintenance	1.07	0.74	0.63
Fixed charges:			
Depreciation at 10% of investment	1.55	1.37	1.25
Property tax and insurance, 1% of investment	0.16	0.14	0.13
Total manufacturing cost, cents/lb. of acetylene	9.02	8.05	7.53
Required cash flow, 25% return	$ 775,000	$1,025,000	$1,250,000
Depreciation	310,000	410,000	500,000
Required profit after taxes	$ 465,000	$ 615,000	$ 750,000
Required pretax profit	$ 965,000	$1,280,000	$1,560,000
Manufacturing cost	1,804,000	2,415,000	3,012,000
Required product value	$2,769,000	$3,695,000	$4,572,000
Required selling price, cents/lb.	13.8	12.3	11.4

is a clear-cut price advantage for acetylene produced in the Houston area. This difference varies from about 1 cent per pound for plants of the same size to over 5 cents comparing the largest Houston plant and the smallest Los Angeles plant.

Transportation. Freight will compensate for part of this advantage. Acetylene itself cannot be economically transported in large volumes over any distance. But vinyl chloride, the largest acetylene derivative, can be used to determine the effect of freight.

The freight rate for inhibited vinyl chloride monomer from Houston to Los Angeles is $2.10 per cwt. in tank-car lots. The rate for polyvinyl chloride varies from $1.81 to $2.01 per cwt. depending on the amount, and whether it is shipped in bags or bulk. Now, how much of this freight can be credited to acetylene?

Vinyl chloride is about 40% acetylene by weight, and about 60% hydrogen chloride. If the 2-cent per pound freight advantage for vinyl chloride were distributed to its raw materials on a weight basis, acetylene would come up with an advantage of 1.8 cents per pound as its share. This is computed by using 0.45 lb. of acetylene required per pound of vinyl chloride.

An argument can be made that hydrogen chloride should receive none of the freight allowance. One reason is that hydrogen chloride is often an unwanted byproduct of another chemical operation and must be disposed of some way. Also, since power costs in the Houston and Los Angeles areas are about the same, chlorine production costs should be about the same in the two areas, for equal-size plants.

Following this line of reasoning, if all freight advantage for vinyl chloride were given to acetylene, acetylene would get a credit of over 4 cents per pound.

One other factor to be taken into account in figuring how the freight credit should be split is the effect of the size of the vinyl chloride monomer and polymer plants.

A 30-million-pound acetylene plant in Los Angeles would support about a 70-million-pound vinyl chloride plant. In the Houston area, a plant might get as large as 150 million pounds. Comparing these extremes in size, the large vinyl chloride plant would have about a 1 cent per pound advantage over the small plant.[4]

The freight advantage to the Los Angeles area can vary from 1 to 4 cents per pound of acetylene depending on the assumptions made. Comparing the required selling prices in Tables 3 and 4, the lower limit on freight advantage will cover only plants of the same size in the two areas. The upper limit, however, would cover the differential in all cases except the extreme of 20 and 100 million pounds.

There are other factors that would work to the advantage of a Los Angeles-area plant. These include such things as better delivery and better technical service. And good technical service is important in marketing vinyl resins.

Taking these plus freight into account, it seems a 30,000,000-lb. plant in Los Angeles could be competitive. A plant sized for say the 1970 acetylene requirement would look even better.

Pacific Northwest. In the Pacific Northwest, low power costs make for conditions favorable to the production of calcium carbide.

The costs for producing acetylene in the Northwest by the carbide route are outlined in Table 5. Acetylene selling prices are determined in the same manner as for Tables 3 and 4.[5,6,7,8,9] The cost buildup in Table 5 shows direct labor costs constitute the major expense in making acetylene from carbide. The process material-handling problems and the equipment used dictate both high operating and maintenance-labor costs. These high labor costs are reflected again

Table 4—Economics for hydrocarbon acetylene in the Houston area

Plant capacity, lb. per year	40,000,000	70,000,000	100,000,000
Investment	$5,000,000	$7,200,000	$9,000,000
	Cents per pound of acetylene		
Raw materials:			
Natural gas at 20 cents/M.M. B.t.u.	2.00	2.00	2.00
Oxygen at $6.50 to $7.70/ton	2.06	1.88	1.74
Operating labor, at $3/hr.	0.26	0.15	0.11
Maintenance, at 3% of investment	0.37	0.31	0.29
Utilities:			
Power, at 8 mills/kw.-hr.	0.32	0.32	0.32
Steam, at 40 cents/1,000 lb.	0.07	0.07	0.07
Cooling water, at 1.5 cents/1,000 gal.	0.20	0.20	0.20
Process water, at 10 cents/1,000 gal.	0.04	0.04	0.04
Chemicals	0.07	0.07	0.07
Royalty	0.30	0.30	0.30
Total direct costs	5.69	5.34	5.14
Less fuel-gas credit, 20 cents/M.M. B.t.u.	1.02	1.02	1.02
Net direct costs	4.67	4.32	4.12
Prorated costs, 140% of labor plus half-maintenance	0.63	0.42	0.35
Fixed charges:			
Depreciation at 10% of investment	1.25	1.03	0.90
Property taxes and insurance, 1% of investment	0.13	0.10	0.09
Total manufacturing cost, cents/lb.	6.68	5.87	5.46
Required cash flow, 25% return	$1,250,000	$1,800,000	$2,250,000
Depreciation	500,000	720,000	900,000
Required profit after taxes	$ 750,000	$1,080,000	$1,350,000
Required pretax profit	$1,560,000	$2,250,000	$2,820,000
Manufacturing cost	2,680,000	4,110,000	5,460,000
Required product value	$4,240,000	$6,360,000	$8,280,000
Required selling price, cents/lb. of acetylene	10.6	9.1	8.3

Table 5—Economics for carbide acetylene in the Northwest area

Plant capacity, lb. per year	20,000,000	30,000,000	40,000,000
Investment	$2,500,000	$3,500,000	$4,400,000
	——Cents per pound of acetylene——		
Raw materials:			
Limestone, chemical grade at $4/ton	0.77	0.77	0.77
Process coke at $10/ton	1.06	1.06	1.06
Electrode paste at $18/ton	0.05	0.05	0.05
Labor at $3/hr.	1.50	1.18	1.01
Utilities:			
Power at 3 mills/kw.-hr.	1.41	1.41	1.41
Cooling water at 2 cents/1,000 gal.	0.09	0.09	0.09
Fuel at 36 cents/M.M. B.t.u.	0.79	0.79	0.79
Chemicals	0.10	0.10	0.10
Maintenance at 6% of investment:			
Labor, 4.2%	0.52	0.49	0.46
Materials, 1.8%	0.23	0.21	0.20
Total direct costs	6.52	6.15	5.94
Prorated costs, 140% operating plus maintenance labor	2.83	2.34	2.05
Fixed charges:			
Depreciation at 10% of investment	1.25	1.16	1.10
Property tax and insurance at 1%	0.12	0.12	0.11
Total manufacturing cost, cents/lb. of acetylene	10.72	9.77	9.20
Required cash flow at 25% return	$ 625,000	$ 875,000	$1,100,000
Depreciation	250,000	350,000	440,000
Required profit after taxes	$ 375,000	$ 525,000	$ 660,000
Required pretax profit	$ 781,000	$1,194,000	$1,376,000
Manufacturing cost	2,146,000	2,934,000	3,683,000
Required product value	$2,927,000	$4,128,000	$5,059,000
Required selling price, cents/lb. of acetylene	14.7	13.7	12.6

in costs for labor burden, supervision, and general overhead. Costs related to labor account for roughly 40% of the manufactured cost of acetylene by this process. Raw-material costs account for about 20% of the total manufacturing cost.

The unit costs in Table 5 for raw materials are at the low end of the expected delivered price ranges. Limestone costs are further minimized by assuming that the dry process for acetylene generation is used. With this process, a portion of the lime from the acetylene generators can be recycled to the lime kiln in the carbide plant. This reduces the amount of limestone purchased.

Buildup of impurities from the limestone and coke limits the proportion of lime recycled. Commercial practice ranges between 0 and 80%. The Braun study assumes a 67% lime recycle.

. . . "it seems that a 30-million-pound plant in Los Angeles could be competitive. A plant sized for say the 1970 acetylene requirement would be even better."

Power costs have been the most important single factor in locating large carbide plants. For the cases studied here, 3-mill power available in the Northwest holds this cost to about 15% of the total acetylene manufacturing cost.

Comparing Los Angeles with the Pacific Northwest, it is clear that low power costs no longer make the carbide route to acetylene an automatic winner. While the costs in Table 3 are for hydrocarbon acetylene production in the Los Angeles area, compensating factors make them substantially the same for the Pacific Northwest.

Costs in the Northwest are higher because natural gas costs a cent or two per million B.t.u. more than in Los Angeles. Costs are also higher because of winterizing requirements. On the other hand, the lower cost of electric power not only reduces the direct power costs as such, but it also reduces the cost of oxygen. These factors compensate each other to the extent that the figures of Table 3 are good for the average conditions in the Northwest.

Within the accuracy of the data used, the hydrocarbon and carbide routes to acetylene are a standoff in the Northwest. Since the bulk of the market for acetylene derivatives is in Los Angeles, freight tips the scales in favor of a Los Angeles location—the freight on calcium carbide from Portland to Los Angeles is $1.01 per cwt., or about 3 cents per pound of acetylene.

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Two-layer coke-formation concept helps determine when to decoke

A NEW CONCEPT of coke laydown inside fired heater tubes postulates that the coke is divided into permeable and impermeable layers. Tube-wall temperatures calculated on this assumption tell when to terminate runs and shut down for decoking.

And the method is useful for finding tube-wall temperatures in existing fired heaters.

The new concept—based on observation and experience—was revealed by G. T. Atkins, a consultant from Baytown, Tex., at the sixteenth annual technical meeting of the South Texas Section of AIChE in Galveston, Tex., last month.

A picture of coke formation during a run shows how the coke is divided into two layers and how tube-wall temperatures are calculated. Consider that the heater is operated throughout the run to maintain a constant oil-outlet temperature. Thus, tube-wall temperatures are highest at the end of the run.

Tube-wall temperatures at the start of a run are a function of the resistances of the turbulent oil film, coke layer, and tube wall. Coking rates increase with temperature and coke layers become thicker. Coke layers close to the tube wall lose any volatiles they may still contain by cracking and thermal decomposition. Result is a dense impermeable coke layer next to tube wall.

However, the most recently formed coke layers near the interface of the coke and turbulent oil film are still porous and grow rapidly. The porous layer is at a temperature higher than the turbulent oil film. Not all the volatiles have yet decomposed in the porous layer.

Calculating temperature. Thus the coke is divided into two layers to calculate the tube-wall temperature. Atkins defines the thermal resistance of the porous layer as equal to the TEMA Fouling Factor for the feed. This enables calculation of a temperature at a representative isotherm of the porous layer. Coking rate can then be considered a function of this temperature.

Curves for various feed stocks are drawn to represent the coking-rate increase in the impermeable layer with time and serve for estimates of tube-wall temperature.

Thus, coking rate—the increase in thermal resistance per unit time—is composed of four resistances: turbulent oil film, porous (TEMA) coke, impermeable coke, and tube wall.

Other variables also influence coking rates. These include feedstock boiling range, heater design, and storage practices. Atkins found thermal-resistance increase per month was least with feed stocks such as naphtha and kerosine with dry points less than 700° F., when stored in tanks under inert gas. The next higher were feed stocks stored in contact with air, and the highest were settled, chemically treated feeds.

Fuel cells as power sources may be closer than you think

IF CURRENT INTEREST is maintained, it is likely that fuel cells will serve as power sources in special application within the next 5 years. Fuel cells to furnish electricity at home are entirely conceivable.

More than 60 governmental and industrial fuel-cell projects, costing $28,000,000 annually, are now under way.

These developments were reported by James D. Flynn, of the Cincinnati Gas & Electric Co. at the fall general meeting of the AIEE.

The goal in mind is that someday this might be a cheap and compact successor to power plants, ranging in size from the internal-combustion engine all the way up to a power-plant generating station, Flynn said.

Initially, fuel cells will be restricted to uses where excellence of fuel efficiency, silence, freedom from fumes, and simplicity of design and operation are important requirements. But as technology advances, offpeak generator facilities may be used to produce hydrogen and oxygen which can be stored, transported, and used at will in fuel cells. The cells may then be used to supply low-voltage constant loads for electrochemical processes.

Remote areas. Fuel cells also may be used to supply electricity in places too remote for power lines or gas mains, using energy in the form of bottled gas or tanks of oil. As fuel cells are small, but efficient, they may be used in small stationary power plants, such as emergency units in hospitals, small factories, motels, and farms.

It is entirely conceivable that there will be a period in our future when central power stations will give way to individual fuel cells in every home. And at a later period, when fossil fuels have become depleted, we may revert again to a central distribution, possibly using a combination nuclear-reactor fuel-cell generating plant, Flynn said.

Advantages of fuel cells are: silent operation, lack of moving parts, convenience in scaling power systems up or down, fewer maintenance and reliability problems, ease of tapping for supplying a variety of loads, relatively high energy per unit weight, and a high specific power output.

Disadvantages are: the tendency for efficiency to be highest at light load and to drop off with increasing load, the voltage drop attendant with increase current output, lack of suitable materials for electrodes and electrolytes, and direct, instead of alternating, current is produced.

Relative ratings on gasoline more important than absolute ON

THE TIME AND EFFORT expended in determining "absolute" octane numbers is often wasted, according to Gene Myers of the Research Department of Standard Oil Co. (Ohio). Speaking to the SAE meeting in national convention in Houston, Myers reported that the relationship in octane rating among fuels is of much greater interest in many cases.

Relative ratings on gasolines can be obtained very rapidly and cheaply by means of appropriate experimental design. For example, seven fuels may be intercompared in an hour, using the rapid technique described, giving a standard error of 0.065 octane numbers. To achieve this low degree of error using conventional technique, approximately 2 days of engine time were necessary.

Blending efforts of gasoline are, by definition, relative. Ninety-three samples containing varying amounts of toluene, isooctane, and diisobutylene were blended and rated in one afternoon. When departures from linearity were calculated, the familiar synergies between isooctane and diisobutylene, and between isooctane and toluene appeared, as did the antagonism between diisobutylene and toluene.

By recognizing that blending nonlinearities are relative, the whole trilinear blending chart was run off in an afternoon instead of the weeks it would normally require.

New construction in Kansas, Mississippi, and New South Wales

CONSTRUCTION has begun near Bushton, Kans., on Helex Co.'s helium-extraction plant, first to be built under the U. S. Government's helium-conservation program. Helex is a subsidiary of Northern Natural Gas Co.

Work crews have started excavating, pouring concrete footings, and laying underground lines at the plant site. The installation, scheduled for completion by next June, is being built by Fluor Corp., of Houston, and will be capable of recovering up to 700 million cubic feet of crude helium a year.

The plant will be centered around an 11-story "cold box" in which will be housed the special low-temperature equipment for separating the helium from the natural gas. This equipment is being manufactured by Air Products & Chemicals, Inc., of Allentown, Pa.

Other units on the site will include two compressor buildings, cooling tower, control house, and auxiliary equipment, such as heat exchangers, dehydrators, and deriming heaters.

The crude helium, a mixture of helium and nitrogen, will be purchased by the federal Government and piped some 300 miles to a storage field near Amarillo, Tex., where it will be stored for future purification as needed by the U. S. Bureau of Mines.

100,000-bbl. Refinery Started

Standard Oil Co. (Kentucky) held ground-breaking ceremonies on November 8 for its new 100,000-bbl. refinery at Pascagoula, Miss. Planning and design work on the 2,700-acre facility in the Bayou Cassotte industrial area 5 miles east of Pascagoula is well under way and the first contract, for clearing the site, has been awarded.

One of the features of the refinery, Mississippi's largest, is an 18,000-bbl. Isocracker. Announced 2 years ago by California Research Corp., a subsidiary of KYSO's parent company, Standard Oil Co. of California, the Isocracking process is capable of making 103 bbl. of 103-octane gasoline out of 100 bbl. of fuel-oil stock.

Work is also expected to begin soon on improving a 7-mile-long channel to the Bayou Cassotte area from the Gulf of Mexico to permit passage of tankships up to 33,000 tons in size. The tankers will be one of the refinery's main lines of distribution to tidewater terminals and bulk plants throughout the KYSO marketing area.

Pascagoula's principal source of crude oil will be the extensive offshore and onshore oil fields operated by the California Company, a Standard of California subsidiary. Production from these fields during 1960 increased to 55,000 bbl. a day, approximately one-fourth of the industry's total production from this source.

Present plans call for the refinery to be tied into the Plantation Pipeline, a products carrier, in which KYSO has a part interest. The Plantation Pipeline extends from Louisiana to the Carolinas, with a lateral into Tennessee.

And a Carbon Tet Plant

Imperial Chemical Industries of Australia and New Zealand, Ltd., (ICIANZ) will build a carbon tetrachloride plant at Botany, New South Wales. The new plant will use a hydrocarbon feed stock from a nearby refinery. Completion is scheduled for late 1962.

ICIANZ is the Australian associate of Imperial Chemical Industries, Ltd., and comprises one of Australia's largest industrial undertakings. The company's operational groups are Nobel (explosives, ammonia, metals); Chemical (biological, general); Alkali; Dyes & Fabrics; Plastics; and Imperial Chemical Industries (New Zealand) Ltd. Among ICIANZ's wholly or partially owned companies are Newcastle Chemical Co. Pty., Ltd., (with Broken Hill Pty., Ltd.); and Balm Paints Pty., Ltd., Australia's leading paint manufacturer.

Carbon tetrachloride is a basic chemical, and a large part of the new plant's output will be used for the manufacture of chlorofluorocarbons, a new industry for Australia. The chlorofluorocarbons, used for modern refrigerants and as propellants for materials dispersed directly from spray cans, will be manufrom spray cans, will be manufactured by two recently formed companies, Australian Fluorine Chemicals Pty., Ltd., and Pacific Chemical Industries Pty., Ltd.

The plant was designed by Scientific Design Co.

Industrial water supply—

City sewage-plant effluent is worth your study—

Effects of residual phosphates and foaming agents are the chief limiting factors

BY C. H. CONNELL
Professor of sanitation, department of preventive medicine and public health, University of Texas Medical Branch, Galveston, and

M. C. FORBES
Technical director, Aquatrol, Inc., Houston

ECONOMIC INTERESTS dictate that process industries choose water of lowest total cost. More than 30 industrial plants in the U. S. have so chosen municipal waste water as a major or supplementary supply. Latest information on sources and users in the oil industry is shown in Table 1.

The cost of industrial use of sewage influent versus the use of fresh water varies widely. Comparative costs in a specific locality can be determined only by on-the-scene engineering surveys.

Dependable Yield Needed

In practice, industrial users of municipal waste water contract to buy specific daily quantities of flow from municipal sewage-treatment plants, delivering effluents of specific water quality. Such a contract is just as firm and dependable as a contract to purchase from a city its unused raw or untreated water.

Dry-weather flow. The dependable daily yield from a sewage-treatment plant is the average daily flow when infiltration of surface and ground water into sewers is at a minimum—the average daily dry-weather flow. Careful study of records of flow and design, construction, operation, and maintenance of the system will show what the dependable daily yield is.

Estimates on major plants of Texas cities are listed in Table 2. These are based on at-plant-site observations, plus study of records supplied by plant superintendents and the Texas State Department of Health. Such information is readily available in most localities.

Storage

Flow from a sewage-treatment plant usually affords a more dependable daily yield than that from alternate sources of industrial water. It might therefore appear that storage would not be needed unless the plant's water demand varies considerably. But sewage plants do suffer upsets. At these times quantity may be the same, but effluent quality may be significantly lower.

Industrial users of munipical waste water have provided storage equivalent to 1 to 10 times the daily water demand.[1] Two-day storage by Champlin Oil & Refining Co., at Enid, Okla., has proved adequate. Ten days' storage was provided at Amarillo by Texaco Inc. in the belief that effluent quality would be significantly improved. Experience has not borne this out, however, and a major part of the reservoir capacity is normally bypassed.[2,3]

Disaster. Hurricane Carla showed how disaster disrupts sewerage service. The sewage-treatment plants of most of the cities from Lafayette, La., to Corpus Christi are potential sources of industrial water. Many of these were partially to completely flooded by Carla. Power, water, and sewer services were interrupted from a few hours to several days. But by the time the most likely users of waste water were back in production, the sewage-treatment plants were also back in operation.

Infiltration. Excessive infiltration of rain and ground water into a sewer system can overload it enough to upset the treatment plant. Salt water, if appreciable and frequent, cannot be compensated for by ef-

Adapted from a paper presented to ASME, Houston, October 1961.

Table 1—Industrial usage of sewage effluents

Industry	Source of effluent	Uses	gal./day
Cosden Petroleum Corp. Big Spring, Tex.	Big Spring sewage plant	Boiler water	0.7
Texaco Inc. Amarillo, Tex.	Amarillo water-reclamation plant	Cooling and boiler water	1.5
El Paso Natural Gas Products Co. Odessa, Tex.	Odessa sewage plant	Cooling and boiler water	2.8
Champlin Oil & Refining Co. Enid, Okla.	Enid sewage plant	Cooling and boiler water	1.1

Table 2—Dependable yield of sewage-plant effluent*
For year 1960

City—	No. of major plants	M.M. gal./day
Houston	2	65
San Antonio	1	55
Fort Worth	2	30
El Paso	1	20
Corpus Christi	2	15
Beaumont	1	10
Galveston	1	5
Odessa	1	5
Amarillo	1	4.5
Tyler	2	3
Texas City	1	3

*Based on personal knowledge of some of the plants, information supplied by respective plant superintendents, and information supplied by State Department of Health.

Table 3—Sewage-treatment plant effluent quality compared with original source water

(All components in p.p.m. units except pH)

	Amarillo, Tex.		Amarillo, Tex.		Enid, Okla.		Houston (N. S. plant)		Odessa, Tex.	
	Tap	Effl.	Tap	Effl.	Tap	Effl.	Tap	Effl.	Tap	Effl.
Total dissolved solids	364	727	364	613	650	844	504	872	327	730
Total hardness ($CaCO_3$)	244	290	244	296	210	250	104	175	120	153
Total alkalinity ($CaCO_3$)	255	248	255	310	210	...	230	344	122	90
pH	7.8	6.5	7.8	7.6	7.7	7.5	7.8	7.8	7.2	7.0
Sodium (Na)	27	85	27	110	30	...	97	180	...	...
Ammonia (N)	...	17	...	12	...	...	...	12	...	4
Magnesium (Mg)	37	12	37	46	70	94	7	16	Trace	Trace
Calcium (Ca)	39	96	39	47	140	156	29	45	37	40
Silica (SiO_2)	56	63	56	79	24	34	28	45	...	...
Nitrate (N)	2	6	1	5	...	...	...	...	2	49
Phosphate:										
Total (PO_4)	...	41	...	20	...	37	...	33	...	50
Ortho (PO_4)	...	40	...	...	...	34	...	30	...	32
Sulfate (SO_4)	34	42	34	78	21	45	8	43	58	115
Chloride (Cl)	13	85	13	83	59	121	53	90	49	165
Carbonate (CO_3)	...	...	...	...	...	...	...	...	...	...
Bicarb. (CO_3)	312	303	312	278	263	...	281	420	149	110
B.O.D. (O)	...	10	...	15	...	19	...	45	...	...
Detergent (ABS)	...	...	...	...	...	...	...	...	...	...

fluent storage. The authors are aware of two instances where preventable salt-water infiltration makes the sewage effluent undesirable for industrial use.

Sewage systems which receive quantities of industrial wastes, from several sources and of variable composition, are most subject to treatment upsets. An industry buying effluent from such a plant must study the city's industrial-waste ordinance. It must encourage the improvements and enforcement of the ordinance, and then provide adequate storage against unavoidable periods of low-quality sewage effluent.

Purchase price. In most cases a municipality can well afford to sell its waste water at a much lower price than it has to charge for water from its unused supplies.

Bethlehem Steel pays Baltimore slightly less than $2 per million gallons for the city's waste water at the point of discharge from the treatment plant. In contrast, Texaco pays more than $100 per million gallons for Amarillo's waste water at the point of discharge from the city's water-reclamation plant.

This difference may be accounted for by the difference in water-pollution control by the two communities.

Since 1915 Baltimore has applied near maximum feasible treatment to its waste water. If Bethlehem Steel did not intercept a major portion of the sewage-plant effluent (now 113,000,000 gal. per day of 155,000,000 gal. per day total) the city would have to chlorinate heavily and apply even more expensive treatment. Or else it would have to transmit the effluent several miles to dilute it.

At Amarillo, primary sewage treatment had proved adequate for pollution control. To conserve water, the city and industry agreed to build a water-reclamation plant, with industry paying the major share of the operating and construction costs.

In each of these, and other instances of reclamation of municipal waste water for industrial supply, industry has procured a dependable low-cost source of water.

Accessibility

Transmission costs are an ever-increasing portion of total costs. Accessibility, therefore, is a factor to consider. Transmission distances are only 1 to 3 miles for Champlin Oil & Refining Co. at Enid, Okla., for Cosden Petroleum Corp.'s Big Spring, Tex., refinery, and for El Paso Natural Gas Products Co.'s plant at Odessa, Tex. Ten miles for Texaco at Amarillo was not prohibitive. At Amarillo the cost of transmission is 20 to 25% of the total cost of the water.[2]

Table 4—Increase in soluble materials in sewage effluents over source waters

Material increasing—	Usual range of increase (p.p.m.)
Magnesium (Mg)	5- 20
Calcium (Ca)	10- 50
Ammonia (N)	2- 20
Silica (SiO_2)	10- 20
Phosphate (PO_4)	15- 50
Nitrate (N)	1- 20
Chloride (Cl)	25-125
Sulfate (SO_4)	10- 40
Alkalinity ($CaCO_3$)	30-100
Soluble organics	10- 50
Total soluble solids	150-500

An estimate of costs of transmission to a specific plant can readily be made. For new plants, these costs can be kept at a minimum by locating close to the outfall of a sewage-treatment plant of adequate flow. There are other advantages of such locations, such as noncongested area, lower cost of land, space for water and industrial storage, and a stream or transmission channel into which the industrial plant can discharge its own treated waste water.

There may be objections on the basis of nuisance and health. But for a sewage-treatment plant capable of delivering a dependable yield of effluent of acceptable quality, operation and maintenance are such that nuisance conditions and hazards are essentially absent. Furthermore, the industrial plant can exist in close proximity, and receive, store, proc-

"In most instances, increase in soluble solids has surprisingly small effect on changing the suitability of sewage-plant effluent for industrial water."

ess, and use the effluent without nuisance or health hazard.

Quality

Table 3 shows analyses of a number of sewage-treatment-plant effluents and of the respective city water supplies from which they came. It is no surprise that the composition of an effluent is closely related to the original water from which it comes. It appears that the relationship is additive rather than a constant ratio.

Table 4 shows some of the ranges of increase in soluble materials that have been noted in comparing the composition of sewage-plant effluents with their related source waters. These incremental ranges are borne out by the values of the sample analyses shown in Table 3.

The use of detergents accounts for the increase in phosphate content, and at the same time causes an increase in syndet concentration equal to 10-30% of the phosphate increase[5]. Detergents also account for nearly all the increase in silica content.

In most instances, increase in soluble solids per se has surprisingly small effect on changing the suitability of the sewage-plant effluent as a source of industrial water.

The problems incurred in the industrial use of municipal waste water are identical to those encountered in the use of water from any other source. They are microbiological fouling, scale formation, corrosion, and foaming.

Microbiological problems. These are generally thought to be severe because of the presence of nutrients (ammonia, nitrates, phosphates, and organic matter). Actually, any industrial waste-water operator will testify that there is no lack of these materials in waters from other sources.

Slime-control agents need not be changed in kind or amount when switching to waste water. However, some chlorine may be required to react with ammonia and some organic substances.

Laxity in microbiological control can aggravate scale and corrosion problems no matter what water source is used.

Scale problems. Scale control has been one of the major problems. The chief offender has been calcium phosphate. Scale formation from this source may be inhibited by internal treatment but it can be prevented only by removing the calcium or the phosphate prior to using the water.

Ion exchange is a practical way to remove calcium from relatively low-hardness waters. Precipitation reactions for the removal of either calcium or phosphate may be impeded by the presence of unreverted polyphosphate. The polyphosphate can best be reverted (or hydrated) to the orthophosphate by raising the pH of the effluent with lime to 9.5 or higher and providing long storage. It helps to add stoichemetric quantities of aluminum or magnesium to react with the phosphate as it reverts. This treatment followed by hot lime or hot zeolite will provide water of high quality[3].

Silica content is of course limiting in feed to high-pressure boilers. There have been no reports of unusual difficulties either in boilers or cooling systems caused by silica from this source.

Corrosion problems. Dissolved salts will increase the conductivity of water which in turn accelerates corrosion. These salts cause no problem in the concentrations usually found. This is true because nearly all the corrosion is an oxygen-controlled electrochemical reaction. The rest is usually metathetical substitution at very high or low pH. Microbiological or scale deposits that form oxygen concentration cells or prevent corrosion inhibitors from reaching the metal surface, will have a far more profound effect on corrosion rate than will any moderate increase in soluble-salt concentration.

A special type of corrosion can occur if excessive quantities of ammonia reach the boiler and distill over with the steam. This ammonia will concentrate in the condensate and attack the copper alloys in the system. On the other hand, by deliberately controlling the ammonia in the steam, corrosion is prevented[3].

Foaming rarely occurs and when it does it can usually be controlled with antifoam. Since most of the syndets are still of the ABS type and therefore anionic, the preferred antifoam would be of the cationic (polyamide) variety.

Economic aspects. Industrial water problems, regardless of the supply source, generally reduce to economic problems. They show up in the operating cost statements as:

1. Increases in capital costs due to overdesigned equipment.
2. Shortened equipment life.
3. Excessive maintenance costs.
4. High operating costs.
5. Lost production.

In systems supplied with water from conventional sources, the sum of these costs can be several times as large as the cost of water from even the most expensive supply. The control of the costs of water use are basically the same whatever the source. Most industrial users of municipal sewage-plant effluent have shown their satisfaction with the qualities of this type of supply by increasing their use of it.

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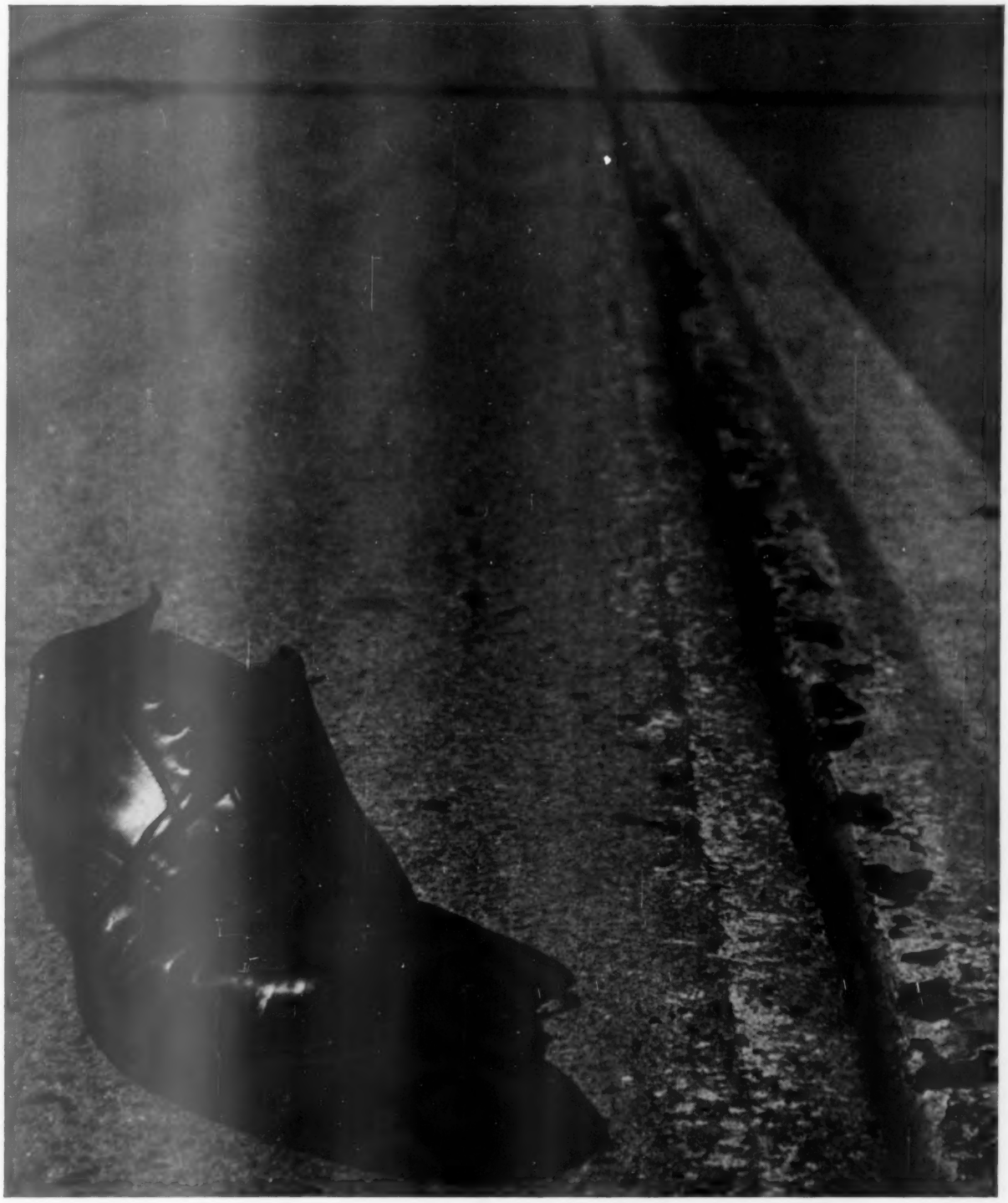

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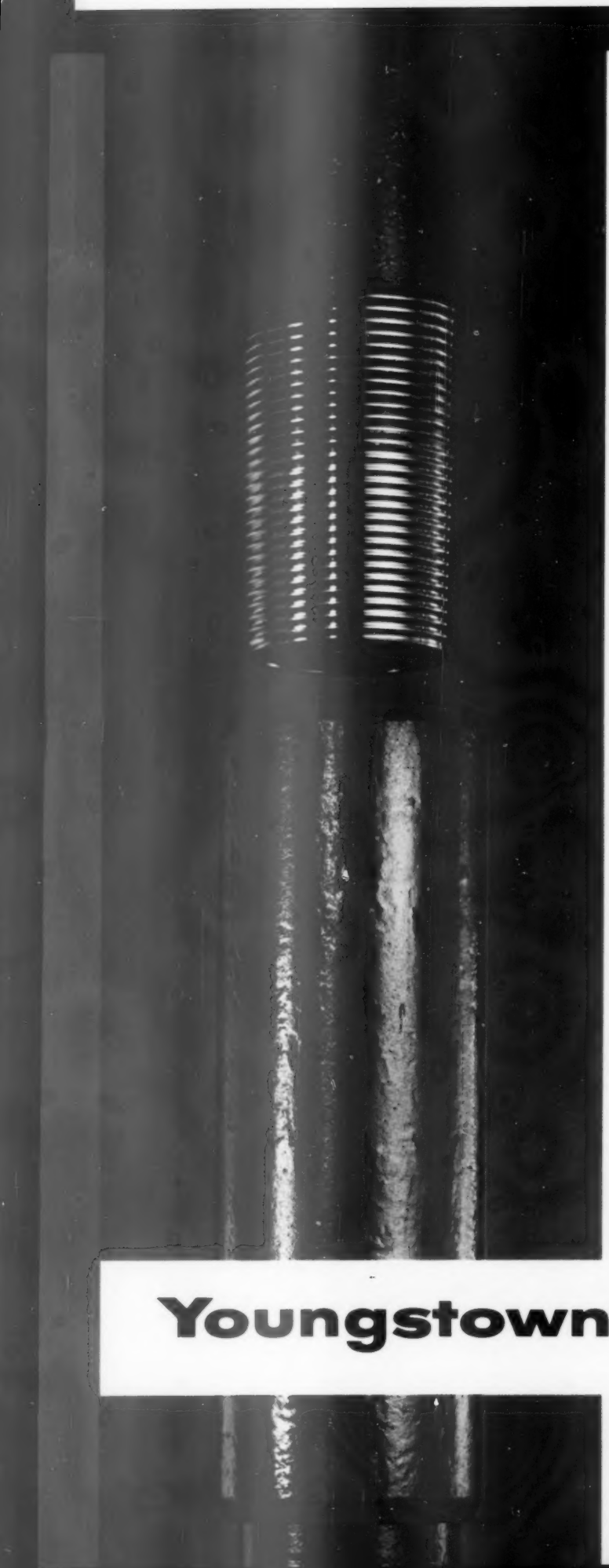

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BP

* *"Synoptic meteorology is a weather-reporting technique based upon the collation and comparison of simultaneous reports from different areas."*

104.

Operating costs for propane dewaxing and the older dewaxing processes

BY W. L. NELSON
Technical Editor and Petroleum Consultant

Table 1 (Propane) and Table 2 (Pressing and Centrifuging) show the cost elements involved in conducting these dewaxing operations. Although no new wax pressing or centrifuge plants are being installed, many small plants (especially for wax pressing) are still in operation. The costs of pressed distillate rerun and of bright stock (and petrolatum) solution rerun operations are not included in the costs of Table 2. Such costs were discussed in Process Costimating No. 93. (May 1, 1961, p. 96).

The equivalent 1956 costs of equipment are somewhat as follows (although data are scarce especially since about 1930):

	BPD*	$/daily bbl.*
Centrifuge (no rerun)	100	4,100
	600	1,160
	1,000	1,270
	1,800	980
Wax (pressing) plants	400	547
	1,200	410
	2,000	360
	3,000	345

*Oil before dilution.

TABLE 1—ELEMENTS OF OPERATING COSTS FOR PROPANE DEWAXING AND DEOILING (COMBINED*), CENTS PER BARREL OF FEED

Element	Unit (somewhat standard)	1956 unit cost	Cents per bbl. for 2,000 B/D	Cents per bbl. for 5,000 B/D	Refer to Process Costimating issues No.:
Labor—operation	3-5 men/shift	$3.12/hour‡	11.2-18.7	4.5- 9.0	26, 28, 41, 50, 57
Labor—supervision	0.4-0.9 men/shift	$3.85/hour‡	1.8- 3.7	0.7- 1.5	
Maintenance	1.5-3%/yr. of replacement	$1,060-1,300/bbl.*	5.3-10.7	4.3-10.2	29, 77
Steam	260-390 lb./bbl.*	45-60 ct./1,000 lb.	11.7-23.4	11.7-23.4	17, 18
Power	1.1-1.5 kw.-hr./bbl.*	0.8-1 ct./kw.-hr.	0.9- 1.5	0.9- 1.5	13, 14, 21-23
Cooling water	300-500 gal./bbl.†	1.3-2 ct./1,000 gal.	0.4- 1.0	0.4- 1.0	15, 16, 38
Propane loss	0.1-0.3 gal./bbl.†	3-7 ct./gal.	0.3- 2.1	0.3- 2.1	
TOTAL DIRECT OPERATING COSTS (Probable extremes)			38.0-58.0	28.0-45.0	
Obsolescence, insurance, taxes, interest, etc. (10%/yr. of replacement)			36	29	99
Royalty, if any (estimated)			2.0- 5.0	2.0- 5.0	7
Laboratory overhead 0.3-1.0 men/shift		$3.12/hour	1.0- 3.0	0.4- 1.5	26, 28
Other possible indirect charges			39.0-43.0	31.0-36.0	

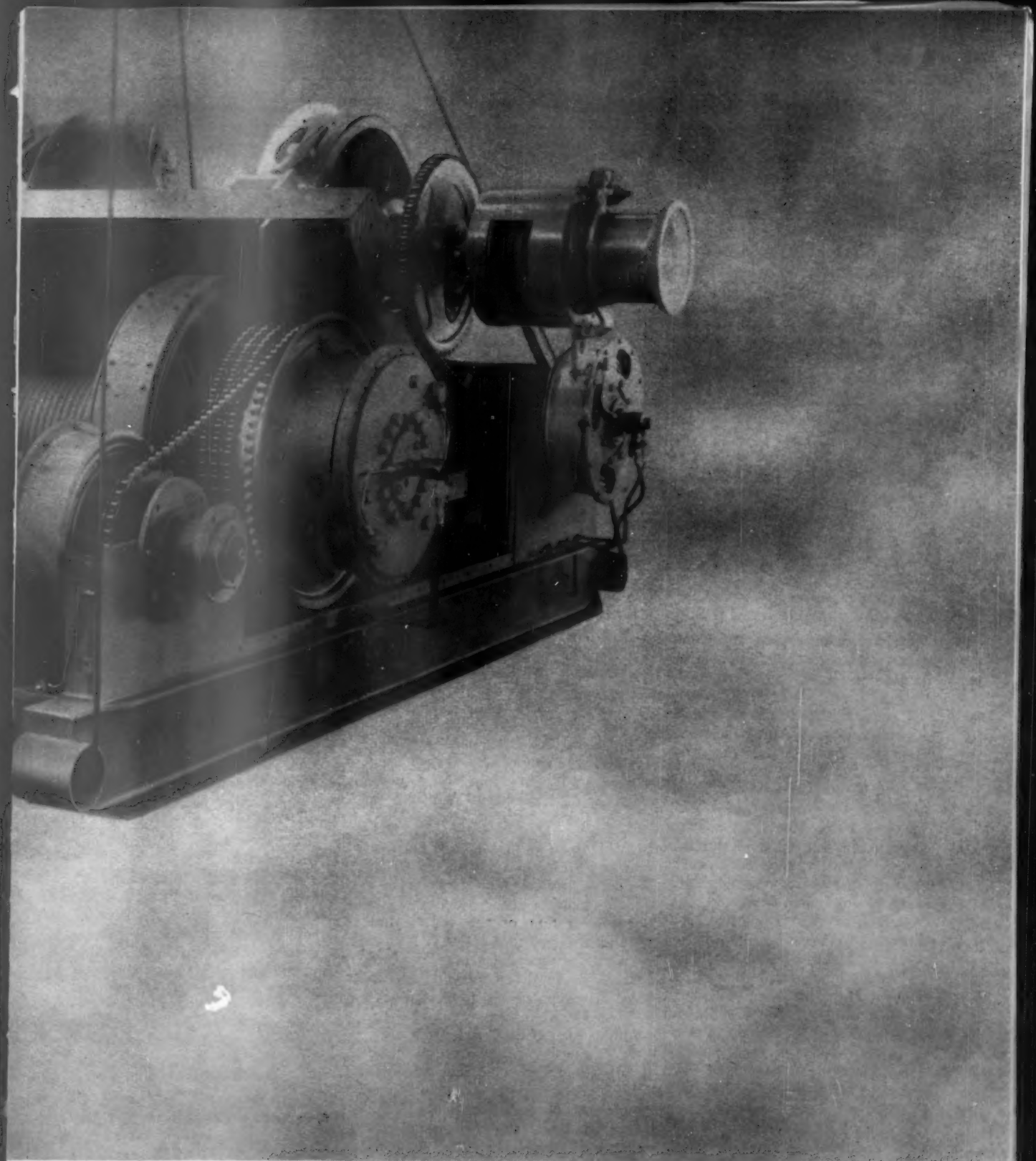
*Considered as 25% additional capacity for deoiling operations. Also some of the utility requirements for deoiling are slightly larger.
†Presumably used with other processes such as deasphalting or deresining and possibly acid treating which reduces the propane recovery costs because they are split between several operations.
‡Average U. S. wages including 27% for all burdens.

TABLE 2—ELEMENTS OF OPERATING COSTS (1956) OF WAX PRESSING AND CENTRIFUGE DEWAXING, CENTS PER BARRELL
(Rerunning Operations not Included).

Element	Unit (somewhat standard)* Presses	Unit (somewhat standard)* Centrifuge	1956 unit cost	Cents per barrel Pressing 2,000 B/D	Cents per barrel Centrifuge 2,000 B/D
Labor—operating	4-5	2-5 men/shift	$3.12/hour†	15.0-18.7	15.0-37.5
Labor—supervision	0.1-0.2	0.1-0.3 men/shift	$3.85/hour†	0.5- 0.9	0.9- 2.8
Maintenance:					
Pressing	4-7%/yr. of replacement		$360/daily bbl.	3.9- 6.9	.....
Centrifuge	.....	1-1.5%	$1,270/daily bbl.	.....	3.5- 5.2
Fuel	12-51,000	6-12,000 B.t.u./bbl.	20-40 ct./M.M. B.t.u.	0.2- 2.0	0.1- 0.5
Steam	18-80	120-140 lb./bbl.	45-60 ct./M lb.	0.8- 4.8	5.4- 8.4
Power	1-4	5-9 kw.-hr./bbl.	0.8-1 ct./kw.-hr.	0.8- 4.0	4.0- 9.0
Cooling water	170-400	1,000-1,600 gal./bbl.	1.3-2 ct./M gal.	0.2- 0.8	1.3- 3.2
Miscellaneous	.....	.....	.....	0.4- 0.7	3.0- 6.0
DIRECT OPERATING COST (probable extremes)				32.0-38.0	41.0-65.0
DIRECT OPERATING COST—literature				20.0-58.0	14.0-48.0
Obsolescence, insurance, taxes, etc. (10% per year of replacement)				‡10	‡35
Laboratory overhead 0.1-0.2 men/shift			$3.12/hour	0.5- 0.9	0.7- 1.5
Other possible indirect charges				‡11	‡36

*Taken from actual operations and the technical literature.
†Average U. S. wages including 27% for all burdens.
‡Although costs are based on what equipments would cost in 1956, no new plants are being installed and hence 10% per year of replacement cost is probably too high.

Sikorsky S-64 Skycranes will carry loads 4½ times



greater than any helicopter in commercial service today.

The Skycrane, now being built, is a completely new helicopter specifically designed for lifting heavy loads. It will pick up and deliver nine tons of you-name-it . . . or carry field offices, tool sheds, kitchens, or nearly any other field unit in interchangeable pods. The Sikorsky Skycrane has power and versatility plus. Send for the complete story today.

SIKORSKY AIRCRAFT DIVISION OF UNITED AIRCRAFT CORPORATION

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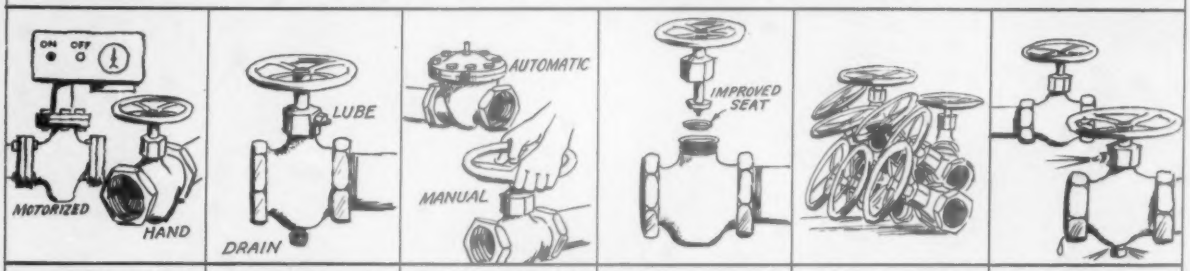
All items selected for evaluation receive careful examination to consider:



1. If there is an equal but less-expensive product available.	2. If there are design changes which would increase serviceable life.	3. If there is an alternative and less-expensive method.	4. If there are metallurgical alternates which would increase life and/or reduce maintenance.	5. If volumes can be combined for purchases and redistributed from a central warehouse to effect savings.	6. Effects of any proposed changes on operation and safety.

Conoco saves $100,000 yearly on upkeep

—with its new value-analysis program

BY KENNETH BROOKS
District Editor

OVER $100,000 a year is being saved on maintenance by Continental Oil Co. through its new value-analysis program, and the figure is growing continuously.

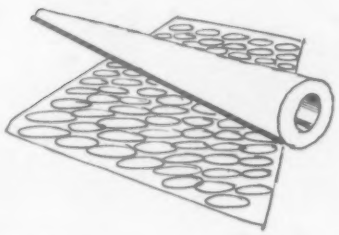
Communications and evaluation are the keys to the program. Ideas flow from plant, engineering, supply, and purchasing people into a central Value Analysis and Standardization Committee (VASCO). This committee, composed of maintenance, engineering, and purchasing specialists, studies maintenance costs to see where major expenditures for equipment exist.

Basically VASCO has two functions. It serves as an information center for collecting and disseminating useful information to all company plants. This often consists of advising other plants of successful experience with a particular item. In other cases, pertinent information is collected, condensed, and issued to all plants to enable them to make a quality judgment in the selection of needed materials.

In addition VASCO acts as a study group to help solve particular problems, especially those brought to their attention by plant people.

How the Program Works

VASCO meets about once a month to determine areas of action. They administer a company test fund available to all plants. The purpose of the test fund is to encourage field testing of new products and equipment for quick evaluation. The administration of the central test fund also provides VASCO with a means of keeping track of plant tests so useful test information can be disseminated and used as quickly as possible. All reasonable requests for test funds are granted.



$3,200 saved on washers

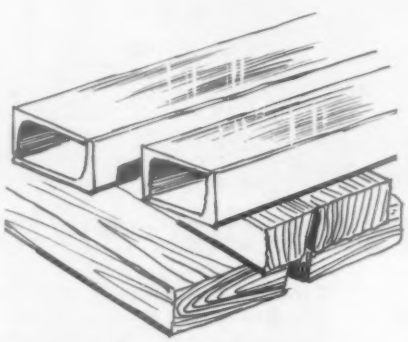
The most profitable activities are concerned with value analysis rather than testing a particular item. Value analysis is accomplished through the combined study efforts of appropriate specialists and plant supervisors. This type of action in many cases eliminates the long time lag inherent in field testing before a quality judgment can be made.

Results

Here are some examples of how value analysis works:

Washers. The cost of washers used to hold wax-press blankets was reduced 45% for an annual saving of $3,200. Formerly, a machine washer was bought from the equipment manufacturer. Following a joint study by the committee and operating people, it was found that a washer stamped by a local machine shop from a ¼-in. plate did the job as well as the machined washer.

Exchanger tubes. Sometimes different purchasing methods and a new product are indicated. Such was the case with exchanger tubes. For more than 2 years, the most popular-size steel exchanger tube has been bought in carload lots, shipped to a central point, and small quantities reshipped to outlying

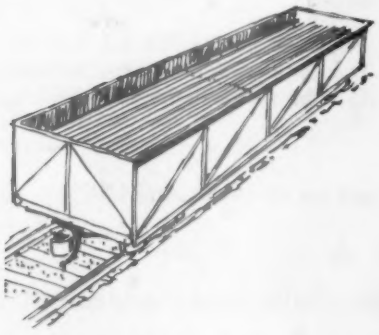


$7,000 saved on exchanger tubes

plants as needed. Electric-welded tubes are bought in place of seamless following appraisal of the weld-testing techniques of the mills approved. Over-all savings from this program exceed $7,000 a year.

Aluminum planks. Wear and tear on wooden scaffold planks is high; consequently replacement cost is high. Wooden planks will weather, splinter, crack, soak up oil, and burn. To avoid this trouble, VASCO promoted the company-wide use of aluminum scaffold boards developed and first used in one of the company's plants.

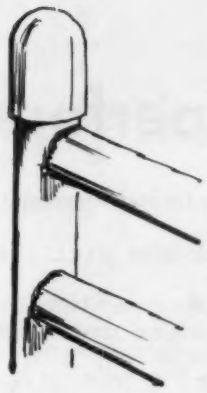
Aluminum planks will handle almost every job that wood will handle. For the same size, they are lighter than wooden planks They have greater load-carrying capacity and a lesser deflection. In addition, the strength properties of aluminum are much less subject to variation. For greater safety, the planks are coated with a nonskid surface.



Aluminum planks: Annual return of over 50%

The planks are made by welding two aluminum alloy extrusions together. With an estimated 10-year life, the payout for investment in metal planks is 1.8 years with an annual return of over 50%.

Stanchion caps. A unique project of VASCO was in the design and development of a supply source of friction-fit stanchion caps. These caps replace standard pipe weld caps used to keep water out of pipe-stanchion vertical-support members. The lightweight friction-fit cap neatly seals the pipe stanchion and requires only a few minutes to tap the cap down over the open pipe with a wooden mallet. No welding is necessary. Savings amount to $15,000 annually.



$15,000 annually saved on stanchion caps

Other actions. Plant surveys and studies have permitted standardizing steam traps for most applications to three varieties. An accelerated steam-hose-testing program provided data resulting in a standardized specification. By volume purchasing for all plants, a better product with longer serviceable life is now obtained with annual savings of several thousand dollars. The cost of small steel gate valves has been greatly reduced through valve analysis studies supported by specially designed accelerated valve testing. In addition, about 50 different items have been purchased with materials test funds and are now being field-tested.

The major portion of the materials testing program has evolved over the past 2 years. Chances are that the firm will soon carry it a step further by placing the responsibility for testing under a full-time engineer.

Here is how the program would operate under the proposed setup:

A steering or decision committee would be established which would meet quarterly to take action on recommendations from its study group. This committee would include one member each from engineering, maintenance, operations, and purchasing. It would outline projects for study group for a projected 3-month period.

A full-time engineer would coordinate the program with guidance from the committee.

His job would be to prepare for committee review information about the item being submitted for testing consideration. This would include figures showing the volume of the item that would be used if the suggestion were adopted. It would include calculations showing the payout to be expected.

He would write sepcifications for materials and would screen new literature and publications for new products which look as if they might be worth appraisal.

In addition he would oversee the testing program. He would prepare for the committee's approval an estimate of the scope, method, objective, cost, and time of each test.

Acknowledgment

This article is based on engineering reports and interviews with Jack A. Haddican, J. F. Leterle, E. A. Shelton, B. L. Applegate, and other committee members with Continental Oil Co., Ponca City, Okla.

BP acquiring giant Atlas computer

THE British Petroleum Co. is getting a giant Ferranti Atlas computer to plan the full-scale integration of its refinery and supply program. The University of London has ordered the $6,000,000 installation. But BP will pay about one-fourth of the cost of the unit in return for which it will have an agreed amount of time on the Atlas for the next 5 years.

The Atlas has aroused considerable interest in the U. S. and Ferranti reports that a number of U. S. firms are studying the system. Claimed to be the most powerful computer in the world, the Atlas is roughly comparable in size to IBM's "Stretch" and Remington Rand Univac's "Larc." However, according to Ferranti, Atlas offers significant advantages in price, speed, cost of operation and versatility. Unlike Stretch and Larc which were developed for specialized applications, Atlas was designed from the outset as a low-cost, general-purpose machine which could handle a large amount of work at high speed.

Special features of the Atlas include a supervisory system for regulating the flow of work through the machine, a floating storage system, known as "page address," for more efficient use of storage space, and a "time sharing" system which permits simultaneous execution of as many as three sets of instructions. Atlas can perform simple instructions (such as additions) at a rate of a million per second.

42. How to find performance and ultimate

GIVEN: Table 1 shows the production history from an initially undersaturated lense-type oil reservoir shaled out on all sides. Fluid properties for this pool are given in columns 2 through 5 of Table 2. Fig. 1 shows the variation of k_g/k_o with total liquid saturation. Other data are as follows:

Interstitial water saturation, S_w = 25.0% of pore volume.

Reservoir temperature, T = 97° F.

Bubble-point pressure, p_b = 1,700 psia.

Average expansibility factors between original and bubble-point pressures:

$c_f = 4.0 \times 10^{-6}$ vol./pore vol./psi.

$c_o = 8.2 \times 10^{-6}$ vol./vol./psi.

$c_w = 3.1 \times 10^{-6}$ vol./vol./psi.

Original reservoir pressure = 2,110 psia.

Gas viscosity at reservoir conditions remained about 0.02 cp. for pressures between the bubble point and 100 psia.

Initial oil in place = 500×10^6 st.-tk. bbl.

No water production or influx ($W_e = 0$, $W_p = 0$).

Original oil formation-volume factor = $B_{oi} = 1.256$.

FIND: Performance and ultimate oil recovery for the reservoir using the Tracy material-balance approach.[1]

METHOD OF SOLUTION: Tracy's form of the material-balance equation for depletion-type pool is:

$$1 = N_{pn}\phi_{on} + G_{pn}\phi_{gn} \qquad (1)$$

and on an incremental basis

Table 1—Production history for lense-type oil pool with depletion drive

Date	Avg. reservoir press., psia.	Cum. production		Average producing GOR, s.c.f./st.-tk. bbl.
		Oil, M. bbl.	Gas, M.M.c.f.	
4-1-50	....	12,150	.....	.....
4-1-51	....	15,830	.....	.....
10-1-51	....	18,270	.....	.....
4-1-52	1,472	21,730	13,005	830
10-1-52	1,450	23,505	.....	860
10-1-53	1,435	25,330	.....	925
4-1-54	1,357	29,300	20,205	1,020
3-1-57	1,043	57,900	59,410	1,765

Table 2—Basic data and calculations to

(1) p_I psia.	(2) B_o	(3) R_s s.c.f./ st.-tk. bbl.	(4) B_g Res. bbl./s.c.f.	(5) μ_o Cp	(6) B_o/B_g (2) ÷ (4)	(7) $(B_o/B_g) - R_s$ (6) − (3)	(8) B_{oi}/B_g 1.265 ÷ (4)	(9) $(B_{oi}/B_g) - R_{si}$ (8) − 540	(10) (7) − (9)
1,700	1.265	540	0.00132	1.19	958	418	958	418	0
1,500	1.241	490	0.00150	1.22	827	337	843	303	34
1,300	1.214	440	0.00175	1.25	694	254	723	183	71
1,100	1.191	387	0.00210	1.30	567	180	602	62	118
900	1.161	334	0.00262	1.35	443	109	483	− 57	166
700	1.147	278	0.00344	1.50	333	55	368	−172	227
500	1.117	220	0.00495	1.80	226	6	256	−284	290
300	1.093	160	0.00860	2.28	127	− 33	147	−393	360
100	1.058	84	0.02720	3.22	39	− 45	047	−493	448

(20) (11)+(19)	(21) ΔN_p (18)÷(20)	(22) N_p Σ (21)	(23) 1 − (22)	(24) (2)×(23)	(25) $\frac{(1-S_w)\times(24)}{\frac{B_{oi}}{(0.75)\times(24)}} = \frac{(0.75)\times(24)}{1.265}$	(26) $S_L =$ (25) + S_w = (25) + 0.25	(27) k_g/k_o from Fig. 1	(28) $(\mu_o/\mu_g)\times(B_o/B_g) =$ $(\mu_o/0.02)\times(6)$
.....	.....	.....	.....	.....	.....	.....	.....	.....
28.293	0.0353	0.0353	0.9647	1.1972	0.710	0.960	0.0043	50,447
16.671	0.0338	0.0691	0.9309	1.1301	0.670	0.920	0.0165	43,375
12.621	0.0350	0.1041	0.8959	1.0670	0.633	0.883	0.0300	36,855
10.801	0.0306	0.1347	0.8653	1.0046	0.596	0.846	0.0495	29,903
8.842	0.0343	0.1690	0.8310	0.9532	0.565	0.815	0.0730	24,975
7.784	0.0315	0.2005	0.7995	0.8930	0.529	0.779	0.1130	20,340
6.997	0.0302	0.2307	0.7693	0.8408	0.498	0.748	0.1670	14,478
4.862	0.0419	0.2726	0.7274	0.7696	0.456	0.706	0.2800	6,279

oil recovery of a depletion-type pool

using the Tracy material-balance approach

BY E. T. GUERRERO

$$\Delta N_p = \frac{1 - N_{p(n-1)}\phi_o - G_{p(n-1)}\phi_g}{\phi_o + \phi_g[R_I + R_{I(n-1)}]/2} \quad (2)$$

Where

$$\phi_o = [(B_o/B_g) - R_s]/X \quad (3)$$

$$\phi_g = 1/X \quad (4)$$

$$X = \{[(B_o/B_g) - R_s] - [(B_{oi}/B_g) - R_{si}]\} \quad (5)$$

Other equations required in the solution are the liquid saturation equation

$$S_L = S_w + (1 - S_w)[(1 - N_p)/B_{oi}]B_o \quad (6)$$

and the instantaneous gas-oil-ratio equation

$$R_I = R_s + (k_g/k_o)(\mu_o/\mu_g)(B_o/B_g) \quad (7)$$

Symbols N_p, G_p, R_I, B_o, B_g, R_s, S_L, S_w, k_g, k_o, μ_o, μ_g, c_f, c_o, c_w, and B_w are defined in Reference 2 and

B_{oi} = initial oil formation-volume factor.

n is subscript to designate any particular point.

i is subscript to designate initial conditions.

c_f, c_o, c_w are expansibility factors for formation, oil, and water, respectively.

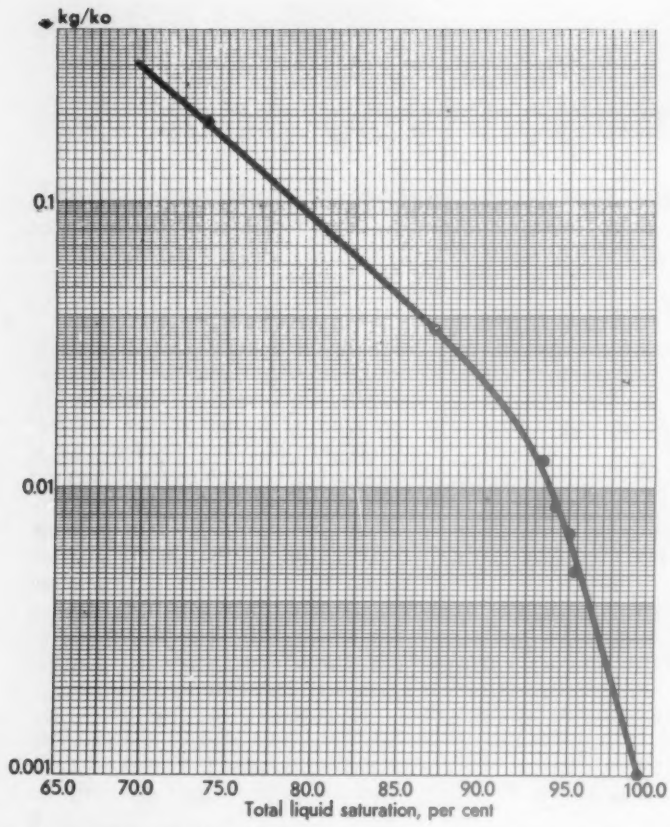
In Equations 1, 2, and 6, N is set equal to unity and all production terms are expressed as a fraction of the actual N. Normally the solution is begun at the bubble-point pressure. But any lower pressure where cumulative gas and oil recoveries are known can be used. From the beginning point pressure decrements of 100 to 300 psi. are used. At every pressure decrement cumulative recoveries are known for the higher pressure end of the decrement from previous calculations or measured data.

Equation 2 involves two unknowns, ΔN_p and R_I. Once this equation is solved, Equations 6, 7, and 1 can be solved. For any se-

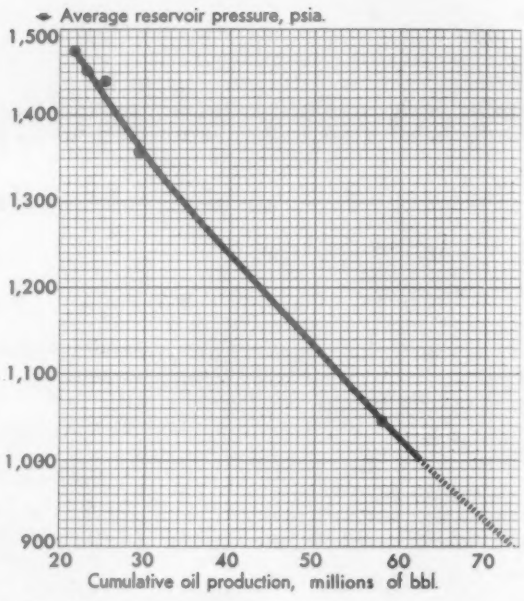
determine performance and ultimate oil recovery

(11) ϕ_o (7) ÷ (10) bbl./bbl.	(12) ϕ_g 1 ÷ (10) bbl./s.c.f.	(13) $R_{I\,est}$	(14) $R_{avg} = [R_I + R_{I\,n-1}] \div 2$ $[(13)_n + (13)_{n-1}] \div 2$	(15) $Np_{n-1}\,\phi_o$ $(22)_{n-1} \times (11)_n$	(16) $Gp_{n-1}\,\phi_g$ $(33)_{n-1} \times (12)_n$	(17) (15)+(16)	(18) 1 — (17)	(19) $R_{avg}\phi_g$ (14) × (12)
∞	∞	540	.....	.....	.....	.....	.....	.....
9.912	0.02941	710	625	.....	.....	.....	1.0000	18.381
3.577	0.01408	1,150	930	0.1263	0.3101	0.4364	0.5636	13.094
1.525	0.00847	1,470	1,310	0.1054	0.4534	0.5588	0.4412	11.096
0.657	0.00602	1,900	1,685	0.0684	0.6014	0.6698	0.3302	10.144
0.242	0.00441	2,000	1,950	0.0326	0.6638	0.6964	0.3036	8.600
0.021	0.00345	2,500	2,250	0.0035	0.7510	0.7545	0.2455	7.763
−0.092	0.00278	2,600	2,550	−0.0184	0.8074	0.7890	0.2110	7.089
−0.100	0.00223	1,850	2,225	−0.0231	0.8193	0.7962	0.2038	4.962

(29) (27) × (28)	(30) R_I from Eq. 7	(31) Computed R_{avg} $[(30)_{n-1} + (30)] \div 2$	(32) $\Delta G_p =$ (21) × (31)	(33) G_p Σ (32)	(34) $G_p\,\phi_g =$ (33) × (12)	(35) $N_p\,\phi_n =$ (22) × (11)	(36) $N = 1.000 =$ (34) + (35)	(37) N_p, st.-tk. bbl. = (22) × (497,036,000)
.....	540	.....	.....	.....	.....	.....	.....	.....
217	707	624	22.027	22.027	0.6478	0.3499	0.9977	17,545,000
716	1,156	932	31.502	53.529	0.7337	0.2472	1.009	34,345,000
1,106	1,493	1,325	46.375	99.904	0.8462	0.1588	1.0050	51,741,000
1,480	1,814	1,654	50.612	150.516	0.9061	0.0885	0.9946	66,951,000
1,823	2,101	1,958	67.159	217.675	0.9599	0.0409	1.0008	83,999,000
2,298	2,518	2,310	72.765	290.440	1.0020	0.0042	1.0062	99,656,000
2,418	2,578	2,548	76.950	367.390	1.0213	−0.0212	1.0001	114,666,000
1,758	1,842	2,210	92.599	459.989	1.0258	−0.0273	0.9985	135,492,000



PERMEABILITY RATIO variation with total liquid saturation. Fig. 1.



CUMULATIVE-OIL-RECOVERY VARIATION with reservoir pressure. Fig. 2.

lected pressure Equations 3 and 4 can be solved since they involve only fluid properties that are a function of pressure.

SOLUTION:

1. Select a pressure decrement, Δp, and for $p = p_{n-1} - \Delta p$ solve Equation 2 for ΔN_p by assuming R_I.

The size of the decrement, Δp, depends on the rate of change of the gas-oil ratio with pressure. The greater the gas-oil ratio change with pressure, the smaller the pressure decrement must be chosen.

2. Solve Equation 6 using $N_p = N_{p\,(n-1)} + \Delta N_p$.

3. Solve Equation 7 for R_I after obtaining k_g/k_o at S_L.

4. If the R_I computed is not approximately equal (to within 50 to 100 s.c.f./st.-tk. bbl. depending on the magnitude of R_I) to the R_I estimated in Equation 2, use the computed R_I and repeat steps 1, 2, and 3. The trial-and-error calculations are continued until R_I, computed, is about equal to R_I, estimated.

5. As a final check at each pressure, solve Equation 1, the right-hand side of which must give a value between 0.991 and 1.009. This will be obtained at each pressure if R_I, computed, and R_I, estimated, are about equal.

From Fig. 1, $k_g/k_o = 0.0495$.

$$R_I = 334 + (0.0495) \times (1.35/0.02)\,(1.161/0.00262)$$

$$= 1{,}814 \text{ s.c.f./st.-tk. bbl.}$$

$$\approx 1{,}900$$

$$\Delta G_p = [R_{I(n-1)} + R_I]/2\ \Delta N_p$$

$$= [(1{,}493 + 1{,}814)/2]\ (0.0306)$$

$$= 50.612$$

At 900 psi.

$$\phi_o = \frac{(1.161/0.00262) - 334}{[(1.161/0.00262) - 334 - (1.265/0.00262) + 540]} = 0.657$$

$$\phi_g = \frac{1}{[(1.161/0.00262) - 334 - (1.265/0.00262) + 540]}$$

$$= 0.00602 \text{ st.-tk. bbl./s.c.f.}$$

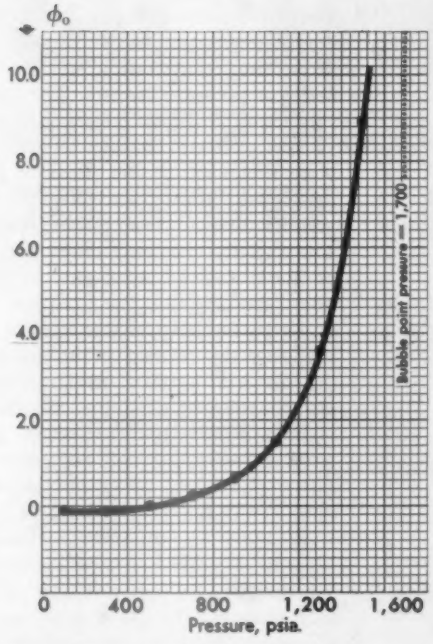
Assume $R_I = 1{,}900$ s.c.f./st.-tk. bbl.

$$\Delta N_p = \frac{1.0000 - (0.1041)\,(0.657) - (99.904)\,(0.00602)}{0.657 + [(1{,}900 + 1{,}470)/2]\,(0.00602)}$$

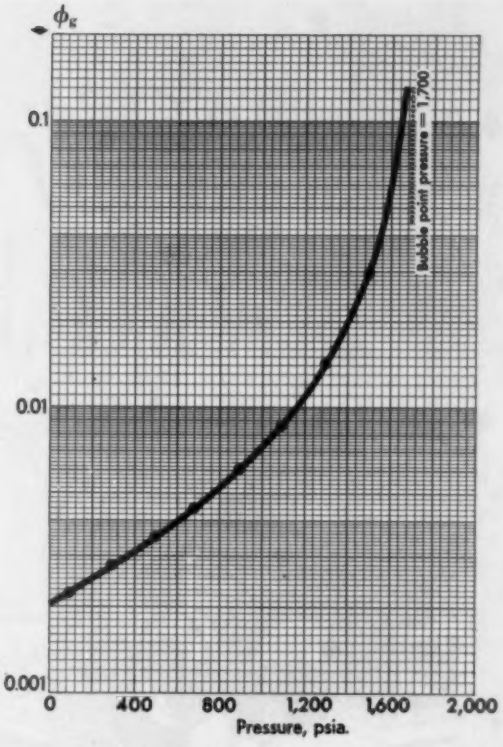
$$= 0.0306$$

$$N_p = N_{p(n-1)} + \Delta N_p = 0.1041 + 0.0306 = 0.1347$$

$$S_L = 0.250 + (1.00 - 0.25)\,[(1.0000 - 0.1347)/1.265]\ 1.161 = 0.846$$



OIL-PRESSURE FACTOR, ϕ_o, as function of reservoir pressure. Fig. 3.



GAS-PRESSURE FACTOR, ϕ_g, as function of reservoir pressure. Fig. 4.

$$G_p = G_{p(n-1)} + \Delta G_p + 99.904 + 50.612 = 150.516$$

Solving Equation 1

$$1.0000 = (0.1347)\ (0.657) + (150.516)\ (0.00602) = 0.9946$$

To convert the values of column 22, Table 2, to barrels, it is necessary to know the oil in place at bubble-point conditions. Using Equations 1 and 2 of Part 33[3] of this series,

$$c_e = c_o + \frac{S_w}{1 - S_w} c_w B_w + \frac{c_f B_f}{1 - S_w} \qquad (8)$$

Where:

B_f = rock formation volume factor

c_e = composite compressibility, vol./pore vol./psi.

Since $B_w \approx B_f \approx 1.00$,

$$c_e = \{8.20 + [0.25/(1.00 - 0.25)] \times 3.1 + [4.0/(1.00 - 0.25]\}\ 10^{-6} = 14.56 \times 10^{-6}$$

$$N = \frac{N_p B_o - (W_p - W_e)}{B_{oi} C_e (p_i - p_b)} \qquad (9)$$

$$500 \times 10^6 = \frac{(N_p)\ (1.265)}{(1.256)\ (14.56 \times 10^{-6})\ (2,110 - 1,700)}$$

$$N_p = \frac{(500)\ (1.256)\ (14.56)\ (410)}{1.265}$$

= 2,964,000 bbl. cumulative oil production to bubble-point pressure.

Therefore, oil in place at the bubble-point pressure is 500,000,000 − 2,964,000 = 497,036,000.

Stock-tank oil recovered to 900 psi. bbl. = (497,036,000) (0.1347) = 66,951,000. Extrapolation of the data in Table 1 gives an actual recovery of 73,000,000 − 2,964,000 or 70,036,000 st.-tk. bbl. to 900 psi. Fig. 2 shows that at 1,300 psia. the actual recovery was about 34,500,000 − 2,964,000 or 31,500,000 while the predicted recovery was 34,345,000 bbl., as shown in Table 2.

Discussion. The method used in this problem to predict recovery and performance of a depletion-type oil reservoir involves an equation that is a rearrangement of the Schilthuis[4] form of the material-balance equation.[1] Equation 2 can easily be obtained from the Schilthuis material-balance equation. Note that Equations 3 and 4 represent portions of Equation 2 that are a function of pressure and temperature. The factors ϕ_o and ϕ_g are called pressure factors and data for their calculation are obtained from bottom-hole fluid analyses. When a gas cap is initially present these factors also involve the ratio of initial gas-cap volume to oil volume in the reservoir.

To predict future performance of a reservoir using the material-balance equation it is common practice to estimate incremental oil production for each pressure decrement in trial-and-error calculations. Tracy's method, used in this problem, better lends itself to estimating the instantaneous gas-oil ratio. A solution is obtained with fewer trial-and-error steps since the instantaneous gas-oil ratio is less sensitive to small inaccuracies.[1]

Table 2 shows the basic data and calculations for determining performance and ultimate oil recovery.

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The first five columns give basic data while columns 6 through 12 show the computation of the oil and gas pressure factors. The pressure factors given in columns 11 and 12 are plotted in Figs. 3 and 4. Note that each of the pressure factors is very sensitive to pressure for conditions near the bubble point. The rapidly changing characteristic of these factors near the bubble-point pressure and the fact that average reservoir pressure cannot be precisely determined point out that the material-balance equation cannot be reliably used for conditions near the bubble-point pressure. This is characteristic of all estimates of oil in place and other applications of the material-balance equation.[1]

In Table 2, columns 13 through 21 solve Equation 2, while columns 22 through 26 solve Equation 6, and columns 27 through 30 solve Equation 7. A comparison of columns 1 and 22 or 37 shows the performance of the reservoir or recovery as the pressure declines.

The sample calculation shows that cumulative oil recovery to the bubble-point pressure was estimated to be 2,964,000 bbl. This was subtracted from the initial oil in place to get oil in place at the bubble point and thus apply the material-balance equation at the bubble point and lower pressures. Table 1 and Fig. 2 show cumulative production and other history data for this reservoir down to a pressure of 1,043 psia. Extrapolation of these data and taking into account oil produced above the bubble point shows that the actual recovery to a pressure of 900 psia. was about 70,000,000 bbl. The value predicted from the material-balance calculations was about 67,000,000 bbl., which is in good agreement with the actual figures. Similarly at 1,300 psia. the actual recovery was about 31,500,000 bbl. while the predicted value was 34,345,000 bbl.

References

1. Tracy, G. W., "Simplified Form of the Material Balance Equation": Trans. AIME (1955), 204, 243.
2. "Standard Letter Symbols for Petroleum Reservoir Engineering and Electric Logging": Journal of Petroleum Technology, October 1956.
3. Guerrero, E. T., "How to Find Original Oil in Place by Material Balance Above the Bubble Point": The Oil and Gas Journal, Feb. 27, 1961, p. 104.
4. Schilthuis, R. J., "Active Oil and Reservoir Energy": Trans. AIME (1936), 118, 33.

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Fractionator internals

. . . many factors determine their design

THE MOST important point to be considered in the design of internals for a fractionator is the degree of contact between the rising vapors and the liquid flowing down inside the tower. The more intimate this contact, the greater will be the separation of components or fractions at any one point in the tower. All other things equal, the investment cost of a fractionator rises with the need for better separation. In other words, if a high degree of separation is not required in a distillation operation, there may be no need to design tower internals for the highest degree of contact. Some towers contain only one type of device in the same tower. Here are three main types of contacting devices found in distillation towers.

A. Bubble trays—A fractionator containing this device would contain a number of plates. These plates are nothing more than circular plates containing holes.

Depending on the service of the tower, it might contain only 3 or 4 or as many as 100 of these plates. Each of the holes on the plate contain what is called a chimney, which is covered with a bubble cap. Fig. 4 shows a bubble cap-chimney arrangement. Fig. 5 shows the arrangement of bubble-cap plates and the flow obtained through them in a typical tower.

Vapors rising up the tower pass through slotted bubble caps, thereby coming in intimate contact with the liquid which is flowing over (or around) the bubble caps. The internal arrangement in the tower is such that the liquid from the tray above falls through a downcomer to the plate below. The liquid then flows over the bubble caps on this plate to another downcomer where it passes on to the tray below.

In this manner, the lighter boiling fractions in the liquid flowing down the tower are vaporized by the heat from the rising vapors. In this exchange of heat, the heavier boiling fractions in the vapor condense and continue on down the tower. It is this process of vaporizing and condensing throughout the tower that permits separation of the feed into the required boiling range fractions.

Some advantages of this type of contacting device are:

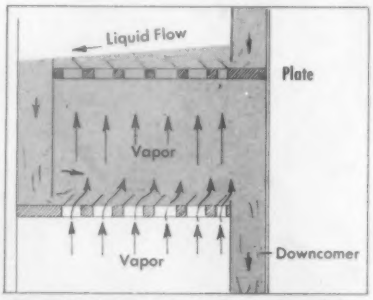
- Wide range of flexibility
- Uniform and intimate contacting.
- High capacity
- Low pressure drop
- Low degree of channeling

Jet trays. This type of contacting device is gradually replacing the bubble-cap plate in some types of service, primarily because of the relatively high efficiency obtained at a low investment cost. A jet tray contains half - moon - shaped holes which have been punched in a circular plate. In making the holes, the metal is not completely punched out but the "lid" from each hole remains attached to the tray. Fig. 6 illustrates the flow through a jet tray. The major advantages of jet trays are:

- Efficient for fixed liquid and vapor loads
- Adaptability, easy to install
- Lower cost than bubble cap plates

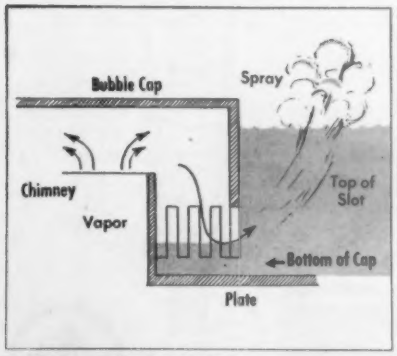
The major disadvantage of jet trays is the fact that they will not function properly over wide ranges of liquid flow rates down the tower or vapor flow rates up the tower. This means that a tower containing such trays has to operate within a fairly narrow range on feed rate and tower temperature. The reason is that no chimneys are used on jet trays to permit a positive liquid holdup. With a jet tray, liquid holdup depends upon the amount of vapor rising through the tray openings.

There are many other trays of this same generic type. These include sieves, dual-flow and float-valve trays among others.

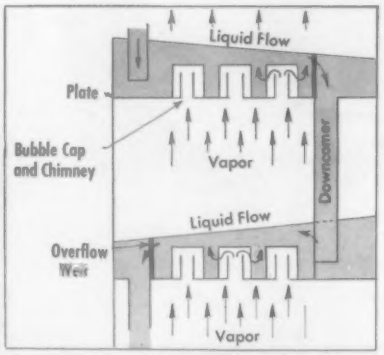


JET TRAYS are more efficient and less costly than bubble trays but they must operate on a smaller range of feed rate and temperature. Fig. 6.

This material taken from process-training-program manual, Bayway, N. J., refinery of Humble Oil & Refining Co.



BUBBLE CAP - CHIMNEY arrangement provides for intimate contact between liquid and vapor. Fig. 4.



BUBBLE-CAP ARRANGEMENT on trays is governed by such things as pressure drop, vapor rate, and ease of maintenance. Fig. 5.

PIPELINE CONSTRUCTION

Who's building where, U. S. and abroad

PIPELINE ACTIVITY reported here is compiled from surveys by The Oil and Gas Journal among pipeline companies and contractors.

This summary appears in the last issue each month. New projects are reported weekly under Pipeline Briefs.

Projects are listed in three groups—U. S., Canadian, and Foreign—and according to type of line—crude, products, natural gas, or miscellaneous.

★ The star symbol indicates the first appearance of the project in the Journal's survey.

U. S. Crude Oil Pipelines

CAL-KY PIPELINE CO., Pascagoula, Miss.
★ Project: 104-mile crude line from Ostrica, La., to proposed refinery at Pascagoula, Miss.
Status: Planned.

CONTINENTAL PIPE LINE CO., Drawer 1267, Ponca City, Okla.
Project: 4-mile, 3-in., 18, 4-in., 68, 6-in., 323, 8-in., and 53, 10-in., Glacier System from Cutbank, Mont., to Byron, Wyo.
Status: Under way.
Contractor: R. H. Fulton & Co., Lubbock, Tex.
Completion: February 1962.
Project: 20.7-mile, 8-in. crude line from Grand Isle to Golden Meadow, La.
Completion: December 31, 1961.
Contractor: Glaser Construction Co.

GREAT NORTHERN PIPE LINE CO., 175 East 4th St., St. Paul 1, Minn.
Project: 64-mile extension to the Lignite field, Burke County, North Dakota.
Status: Planned.

MATADOR PIPE LINE CORP., Denver, Colo.
Project: 175-mile line from Burke, Bottineau, and Renville counties, North Dakota, to Cromer, Man.
Status: Approved by CNEB.
Completion: December 31, 1961.

MID-CONTINENT PIPE LINE CO., Tulsa, Okla.
★ Project: 25-mile, 4-in. line from Muskogee field to Bald Hill Station.
Status: Under way.
Completion: February 1, 1962.

MURPHY CORP. and **PLACID OIL CO.**, Denver.
★ Project: 22-mile, 4-in. line from Tule Creek field, Montana, to Butte Pipeline. line.
Status: Under way.
Contractor: Oil Field Service.

SHELL PIPE LINE CORP., Box 2648, Houston 1, Tex.
Project: 34-mile, 8-in. condensate line from Bryans Mill to Humble Pittsburgh station.
Status: Planned.
Completion: Dec. 1961.
Project: 12-mile, 12-in. line from Pelican Island to Nairn Junction.
Status: Planned.
Completion: Jan. 1962.

U. S. Products Pipelines

AMERICAN PETROFINA CO., Rockefeller Center, New York, N. Y.
Project: 133-mile, 6-in. line from Mount Pleasant to Dallas-Fort Worth area.
Status: 80-mile section, Greenville to Mount Pleasant, under way.
Contractor: Fowler-Tatom Pipeline Contractor, Inc.

CONTINENTAL PIPE LINE CO., Bartlesville, Okla.
Project: 225-mile products line, Ponca City, Okla., to Wichita Falls, Tex.
Status: Planned.

DIXIE PIPE LINE CO., 800 Enterprise Building, Tulsa.
Project: 1,077-mile, 12, 10, 8 and 6-in. LPG line from Mont Belvieu, Tex., to Cary, N. C.
Status: Under way.
Completion: Dec. 1961.
Contractors: Section 1, Houston Contracting Co.; Section 2, Sharman, Allen, Gay & Taylor; Section 3, H. B. Zachry Co.; Section 4, O. R. Burden Construction Co.; Section 5, Stanley-Bledsoe Corp.

EL PASO NATURAL GAS CO., El Paso, Tex.
Project: 58-mile, 6 in. LPG line Jal, N. M., plant to El Paso Natural Gas Products Co. refinery, Odessa, Tex.
Status: Planned.

GREAT LAKES PIPE LINE CO., Kansas City, Mo.
Project: Conversion of 6-in. products lines from Des Moines, Iowa, to Minneapolis and to Chicago area to tie-in with Northern Gas Products LPG line from Bushton, Kans.
Status: Planned.

HUMBLE PIPE LINE CO., Box 2220, Houston, Tex.
Project: 270-mile line west from Baytown, 177 miles 8 and 10-in. with 6-in. branches 43 miles to Austin and 50 miles to San Antonio.
Status: 20.6-mile, 10-in. from Clear Lake to Pierce Junction under way.
Contractor: T-T Construction Co.
Completion: April 1, 1962.

MID-AMERICA PIPELINE CO., 1437 S. Boulder, Tulsa.
Project: 100-mile extension from Ogden to Charles City, Iowa.,
Status: Planned.
Construction: 1962.

NORTHERN GAS PRODUCTS CO., Omaha, Neb.
Project: 350-mile, 8-in. LPG line from Bushton, Kans., plant to Des Moines, Iowa, connecting with Great Lakes 6-in. lines to Twin Cities and to Chicago area.
Status: Planned.

OLYMPIC PIPELINE CO. (proposed)
Project: 94 miles, 16-in.; 162 miles, 11-in., 45 miles, 8-in. and 23 miles, 6-in. from Ferndale and Anacortes, Wash., refineries to Seattle and Portland.
Status: Planned.

POTOMAC PUBLIC SERVICE CO., Arlington. Va.
Project: 80-mile, Baltimore to Washington airports.
Status: Planned.

SERVICE PIPE LINE CO., Box 1979, Tulsa, Okla.
Project: 21-mile. 4-in. LPG line from Port Acres to Beaumont Junction, Tex.
Status: Planned.

SOUTHERN PACIFIC PIPE LINES INC., San Francisco 5, Calif.
★ Project: Approximately 100-mile line to serve Portland, Albany and Eugene, Ore.
Status: Proposed.

TEXAS EASTMAN CO., Longview, Texas.
Project: 275 miles, 6-in. LPG line from Sweeney to Longview, Tex.
Status: Under way.
Completion: December, 1961.
Contractor: O. R. Burden Construction Co.

TEXAS EASTERN TRANSMISSION CORP., Box 1189, Houston 1, Tex.
Project: 6-mile, 8-in., Deer Park to Pasadena, Tex.
Status: Planned.

U. S. Natural Gas Pipelines

ALAMO GAS SUPPLY CO., Alamo National Building, San Antonio, Tex.
Project: 166 miles of 20, 22, and 24-in. line and 101 miles of 12, 16, and 24-in. line from Texas Gulf Coast to San Antonio.

AMERICAN LOUISIANA PIPE LINE CO., Detroit, Mich.
Project: 25-mile, 8-in. to connect Holly Ridge field, Tensas Parish, Louisiana, to main line.
Status: Pending FPC approval.

BI-STONE FUEL CO., Corsicana, Tex.
Project: 100-mile, 16-in. main line from Bethel field, Anderson County, to Merit, Hunt County, North Texas, with 75 miles, 10, 8 and 6-in. laterals.
Status: Planned.

BORDER GAS TRANSMISSION CORP. (Lehman Brothers, New York, and Rio Gas Gathering Co., 615 National Bank of Commerce Building, San Antonio 5, Tex.).
Project: Gathering lines in Starr, Zapata, Jim Hogg, Brooks, and Webb counties, Texas.
Status: Proposed.
Project: Gathering lines in Dimmit, Zavala, and La Salle counties, Texas.
Status: Proposed.

CARL M. LOEB, RHOADES & CO., 42 Wall St., New York 5.
Project: 75-mile, 20-in. from New Jersey refineries to Long Island airports, Idlewild and La Guardia.
Status: Proposed.

CHEROKEE PIPE LINE CO., Bartlesville, Okla.
★ Project: 30-mile, 8-in. line from Wichita Falls to Temple, Tex.
Status: Under way.
Contractor: Williams Brothers Co.
Completion: Dec. 15, 1961.

CITIES SERVICE GAS CO., Box 1995, Oklahoma City 1, Okla.
Project: 10½ miles of 8-in. to connect Rounds and Porter plant with main line in Marion County, Kansas.
Status: Planned.
Project: Gathering lines in Sterling field, Comanche County, Oklahoma.
Status: Pending FPC approval.

COASTAL TRANSMISSION CO., Houston, Tex.
Project: 71 miles laterals in Florida.
Status: Approved by FPC examiner.

COLORADO GAS TRANSMISSION CO., Colorado Springs, Colo.
Project: 250-mile, 20-in. line, from Ignacio-Blanco area, Southwest Colorado, to Walsenburg, Pueblo and Colorado Springs, Colo.

PIPELINE CONSTRUCTION

Status: Application before Colorado PUC.

COLORADO INTERSTATE GAS CO., Box 1087, Colorado Springs, Colo.
Project: 7 miles of 20-in. in Texas Panhandle.
Status: Pending FPC approval.
Completion: 1961.
Project: 109 miles of 26-in. from Texas Panhandle to southeastern Colorado; 134 miles of 34-in. from there to Pueblo, and 107 miles of 30-in. on to Denver.
Status: Pending FPC approval.
Project: 155 miles of 34-in. from Rock Springs, Wyo., to Provo, Utah, to connect with El Paso's proposed 395-mile line to California.
Status: Approved by FPC.
Completion: 1963.
Project: 32 miles of 6-in. from Central Colorado to Trinidad.
Status: Pending FPC approval.

COLORADO OIL & GAS CORP., Denver, Colo.
Project: 402-mile line from Gubik field to Fairbanks, Alaska.
Status: Proposed.

COLORADO-WYOMING GAS CO., Box 480, Denver 1, Colo.
Project: 4-mile, 3-in. lateral to Erie, Colo.
Status: Pending FPC approval.
Project: 2-mile, 4-in. lateral to Niwot, Colo.
Status: Pending FPC approval.

COLUMBIA GAS SYSTEM, INC., 120 East 41 St., New York 17.
Projects: Eight loops totaling 96.9 miles, 30-in. in Kentucky, Tennessee, Mississippi and Louisiana, plus 29 miles of 12-in. gathering line from near Houma, La., to the Texaco Dog Lake field.
Status: Planned.
Completion: 1961.

COLUMBIA GULF TRANSMISSION CO., Box 683, Houston 1, Tex.
Project: 97 miles of main-line loop in Kentucky, Tennessee, Mississippi, and Louisiana, and 29 miles of 12-in. lateral supply lines in Louisiana.
Status: Pending FPC approval.
Completion: 1961.
★ Project: 391 miles, 30-in. loops between Alexandria, La., and Leach, Ky.
Status: Proposed.

EAST TENNESSEE NATURAL GAS CO., Knoxville, Tenn.
Project: 10.1 miles, 4-in. lateral to South Carthage, Tenn., and 13.4 miles, 6-in. lateral to Pleasant Hill, Tenn.
Status: Planned.

EL PASO GAS SUPPLY CO., (subsidiary of El Paso Natural Gas Co., Box 1492, El Paso).
Project: 228-mile, 30-in. line, Live Oak County to Sonora, Sutton County.
Status: Pending FPC approval.

EL PASO NATURAL GAS CO., Box 1492, El Paso, Tex.
Project: 61.3-mile, 10¾-in. lateral to Bremerton, Wash., to be extended 75 miles to Port Angeles by Natural Gas Transmission Co., El Paso subsidiary.
Status: Before FPC.
Project: 8.2-mile, 34-in. loop on Gallup discharge.
Status: Pending FPC approval.
Project: 14.2-mile, 6⅝-in., South Sawyer to Sinclair plant 29.
Status: Pending FPC approval.
Project: 17 mile, 8⅝-in. from Pacific Gas Transmission 36-in. line to Klamath Falls, Ore.
Status: Pending FPC approval.
Project: 34.2-mile, 20-in. from Puckett line tie-in to Goldsmith plant.
Status: Pending FPC approval.
Project: 23-mile, 20-in. loop on Goldsmith plant-Eunice Plains line.
Status: Pending FPC approval.
Project: 27.5-mile, 34-in. loop on San Juan mainline.
Status: Pending FPC approval.
Project: 118.7-mile, 30-in. Permian-San Juan crossover loop.
Status: Pending FPC approval.
Project: 42.3-mile, 30-in. southern system second loop west of Florida station.
Status: Pending FPC approval.
Project: 210.2-mile, 16-in., Keystone mainline station to El Paso.
Status: Pending FPC approval.
Project: 391.4-mile, 34-in. Thistle, Utah, to California-Nevada border.
Status: Pending FPC approval.

GRAND VALLEY TRANSMISSION CO., Green River, Utah.
Project: 16-mile line from Westover field, Grand County, to El Paso Natural Gas Co. main line.
Status: Approved by FPC.

HOUSTON TEXAS GAS & OIL CORP., Box 10400, St. Petersburg 33, Fla.
Project: 174.2 miles, 2⅜-in. to 6⅝-in. distribution lines in Florida.
Status: Pending approval.

HUMBLE OIL & REFINING CO., Houston, Tex.
Project: 13.5-mile, 26-in. line from Port Acres to Bridge City, Tex.

IROQUOIS GAS CORP., Buffalo, N. Y.
Project: 21.5 miles of line, 2 miles, 16-in.; 5.5 miles, 12-in.; 14 miles, small diameter, to serve Perrysburg storage.
Status: Before FPC.

MANUFACTURERS LIGHT & HEAT CO., Union Trust Building, Pittsburgh 19, Pa.
Project: 20-mile, 20-in., Glenville, W. Va., to New Milton District.
Status: Pending FPC approval.

MICHIGAN WISCONSIN PIPE LINE CO., 500 Griswold St., Detroit, Mich.
Project: 64.5 miles, 4/10-in. Laverne field gathering lines.
Status: Planned.
Completion: Gradually over 1961.
Project: 97 miles, 16/20-in. gas line from Woodward, Okla., area to Greensburg, Kans., compressor station.
Status: Approved by FPC.
Project: 68 miles, 4/10-in. gathering system, Woodward, Okla., area.
Status: Approved by FPC.
Project: 26 miles, 30-in. loop in Michigan, 10 miles, 12-in. loop in Wisconsin.
Status: Pending FPC approval.
Project: 30 miles, 30-in. from Station 10 to Woolfolk station, Wisconsin.
Status: Approved by FPC.

MISSISSIPPI RIVER FUEL CORP., 407 North 8th Street, St. Louis 1, Mo.
Project: 5 miles of 16-in. and 15 miles of 12-in. from Collinsville, Ill., to St. Jacob, Ill.
Status: Pending FPC approval.

MONTANA-DAKOTA UTILITIES CO., Minneapolis, Minn.
Project: 106-mile, 12-in.; 22-mile, 3-in.; 20-mile, 2-in., Minot to Bismarck, N. D.
Status: Pending FPC approval.
Project: 12-mile, 6-in.; 17-mile, 4-in.; 2-mile, 2-in., Alexander to Watford City, N. D.
Status: Pending FPC approval.
Project: 14-mile, 8-in., McGregor to Tioga, N. D.
Status: Pending FPC approval.
Project: 3-mile, 3-in., lateral to Fryburg, N. D.
Status: Pending FPC approval.
Project: 2-mile, 4-in., lateral to Holly Sugar Corp., Hardin, Mont.
Status: Pending FPC approval.

MONTEREY GAS TRANSMISSION CO., Houston, Tex.
★ Project: 216-mile, 30-in. from Clear Lake, Tex., to Station No. 9, Columbia Gulf Transmission Co., near Alexandria, La.
Status: Pending FPC approval.

NATURAL GAS PIPELINE CO. OF AMERICA, 122 South Michigan Avenue, Chicago.
Project: 258.92 miles 30-in. loop line in Victoria, Wharton, Montgomery, Liberty, Panola, Harrison counties, Texas; Clark, Grant and Lawerence counties, Arkansas, and Washington, Marion, Clinton, McLean and Livingston counties, Illinois.
Status: Under way.
Completion: Dec. 8, 1961.
Contractors: 133.78 miles, Panama-Williams Corp.; 78.02 miles, Williams Brothers Co.; 47.12 miles, R. H. Fulton & Co.
Project: Two 30-in. loops, 38 miles between Gum Spring and Nydis and 40 miles from Rowhatan to Missouri border.
Status: Under way.
Contractor: Williams Brothers Co.

NORTHERN NATURAL GAS CO., 2223 Dodge St., Omaha 1, Neb.
Project: 14 miles, 26-in. loop east of Waterloo, Iowa, and 365 miles 2-in. to 16-in. to serve 44 communities in Wisconsin, 17 in Minnesota, 3 in Iowa and one in Nebraska.
Status: Pending FPC approval.
Completion: 1962.

OKLAHOMA-ILLINOIS GAS PIPELINE CO., M. & M. Bldg., Houston 1, Texas. (Joint Fish Engineering Corp., Pan American Petroleum Corp. and Shell Oil Co. venture)
Project: 600-mile, large diameter line from Woodward, Okla., to St. Louis, Mo.
Status: Proposed.

PACIFIC GAS & ELECTRIC CO., 245 Market St., San Francisco, Calif.
Project: 67 miles of line from Kettleman Hills to Morro Bay, Calif.
Project: 120 miles of 34-in. looping of Topock-Milpitas main line.
Status: Planned. Pending FPC approval.
Completion: 1963.
Project: 291 miles of 36-in. from the California-Oregon border to Antioch, Calif. (Part of a 1,400-mile project to move Alberta gas to San Francisco.)
Contractor: H. C. Price Co., Bartlesville, Okla. (Bechtel Corp. San Francisco, is the engineering manager.)
Status: Under way.
Completion: Dec. 1961.

PACIFIC GAS TRANSMISSION Co., (Pacific Gas & Electric Co., San Francisco).
Project: 611 miles of 36-in. from the Canadian border at Eastport, Idaho, to the California border near Klammath Falls, Ore. (Part of a 1,400-mile project to move Alberta gas to San Francisco.)
Contractors: Western Pipe Line, Inc., Austin, Tex., and J. P. Neill & Co., Dallas, have contracts for the 465-mile southern portion. H. C. Price Co., Bartlesville, Okla., has contract for the 146-mile northern portion from Rosalia, Wash., to Eastport, Idaho. (Bechtel Corp., San Francisco, is the engineering manager.)
Status: Under way.
Completion: Dec. 1961.

PACIFIC LIGHTING GAS SUPPLY CO., 720 W. Eighth Street, Los Angeles 17, Calif.
Project: 24 miles, 16-in. Gaviota to Goleta, Calif.
Status: Pending California PUC approval.
Completion: Spring, 1962.

PANHANDLE EASTERN PIPE LINE CO., 120 Broadway, New York.
Project: 298 miles of 30-in. loops, 43 miles of 16 to 26-in. supply laterals, and 80 miles of 6 to 12-in. sales laterals.

PIPELINE CONSTRUCTION

Status: Pending FPC approval.
Project: 150 miles, 24-in., 50 miles, 22-in. from Elk City, Okla., field to main line.
Status: Approved by FPC.

PIONEER NATURAL GAS CO., Amarillo, Tex.
Project: 21 miles of 12-in. from Sudan to Muleshoe, Tex.
Status: Pending FPC approval.
Project: 12 miles of 10-in. from Muleshoe, Tex., northward.
Status: Pending FPC approval.

ST. LAWRENCE GAS CO., Ogdensburg, N. Y.
Project: 75 miles of line near Cornwall, Ont., to Ogdensburg, N. Y.
Status: Approved by FPC.

SOUTHERN CALIFORNIA GAS CO., and SOUTHERN COUNTIES GAS CO. OF CALIFORNIA, Los Angeles, Calif.
Project: 92.9-mile, 34-in., Ivanpah to Newberry, Calif.
Status: Approved by California PUC.
Completion: Jan. 1, 1964.

SOUTHERN NATURAL GAS CO., Birmingham, Ala.
Project: 14.4 miles, 20-in. gas line from Gwinville field to Pickens station.
Status: Pending FPC approval.
Completion: Dec. 31, 1961.

SOUTHERN UNION GAS CO., Fidelity Union Tower, Dallas 1, and **EL PASO NATURAL GAS CO.**, Box 1492, El Paso, Tex.
Project: 60-mile line from El Paso's main line near Holbrook, Ariz., to paper mill under construction near Snowflake.
Status: Planned.

TENNESSEE-CALIFORNIA GAS TRANSMISSION CO., Box 2511, Houston, Tex.
Project: 105-mile, 26-in. line from Humble's King Ranch via Kleberg, Brooks and Hidalgo counties to Mexican border to connect with Tennessee-Pemex line to California. Included are 69 miles of 12-in. and smaller laterals.
Status: Pending FPC decision.

TENNESSEE GAS PIPELINE CO., a division of Tennessee Gas Transmission Co., Box 2511, Houston 1, Tex.
Project: 7.4 miles, 12-in. gathering line, offshore Louisiana.
Status: Under construction.
Contractors: Sam Carline, Inc., laying contractor; Brown & Root, Inc., burying contractor.
Project: 18.5 miles, 12-in. gathering line, offshore Louisiana.
Status: Under construction.
Contractor: Brown & Root, Inc.
Project: 12.6 miles, 12-in. gathering line, offshore Louisiana.
Status: Under construction.
Contractor: Brown & Root, Inc.
Project: 20.6 miles, 12-in. gathering line, offshore Louisiana.
Status: Pending FPC approval.
Project: 13 miles, 20-in. gathering line, offshore Louisiana.
Status: Under construction.
Contractor: J. Ray McDermott, Inc.
Project: 6 miles, 12-in. gathering line, offshore Louisiana.
Status: Approved by FPC.

TENNESSEE GAS TRANSMISSION CO., Box 2511, Houston, Tex.
Project: 1,100-mile, 30-in. line Texas to California via Mexico (see Foreign).
Project: 292-mile line from the California-Mexican border to Los Angeles to tie in with above-mentioned line.
Status: Tennessee Gas' subsidiary, California Gas Transmission Co., and Southern California Edison Co. have applied to California PUC. Also pending FPC approval.
Project: A line from King Ranch, Texas, to the Mexican border, to connect with proposed line through Mexico to California.
Status: Tennessee Gas subsidiary, Tennessee California Gas Transmission Co., to build and operate the Texas segment.

TEXAS EASTERN TRANSMISSION CORP., Box 1189, Houston 1, Tex.
Projects: 165 miles of 20-in. from West Monroe, La., to Kosciusko, Miss.
Status: Under way.
Contractor: Houston Contracting Co., Pentzien, Inc.
Completion: 1961.
Project: 40 miles, 36-in., Station 26 to Station 27, N. J.
Status: Under way.
Contractors: H. C. Price Co., Napp-Grecco Co.
Completion: 1961.
Project: 89 miles, 30-in. Kosciusko station, Miss., and Station 21-A, Pa.
Status: Under way.
Contractors: Western Pipeline, Inc., Bechtel.
Completion: 1961.
Project: 40 miles, 30-in. Delmont station, Pa., to Station 26, N. J.
Status: Under way.
Contractor: Tulsa Williams Inc.
Completion: 1961.
Project: 45 miles, 30-in. Delmont station, Pa., to Station 26, N. J.
Status: Planned, filed with FPC.
Completion: 1962.
Project: 42 miles, 30-in., Kosciusko station, Miss., to Station 21-A, Pa.
Status: Temporary FPC approval.
Completion: 1962.
Project: 57 miles, 14-in., Castor, La., to West Monroe, La.
Status: Planned, filed with FPC.
Completion: 1961.
Project: 13 miles, 14-in. Middlesex County, to Barnardsville, N. J.
Status: Planned, filed with FPC.
Completion: 1962.
Project: 14 miles, 12 in., Barnardsville to Roseland, N. J.
Status: Planned, filed with FPC.
Completion: 1961.
Project: 11 miles, 10-in., Middlesex County to Helvetta, N. J.
Status: Planned, filed with FPC.
Completion: 1961.

TEXAS GAS TRANSMISSION CORP., Owensboro, Ky.
Project: 35 miles, 30-in. and 21 miles, 26-in. in Tennessee, Mississippi, Arkansas, Louisiana.
Status: Under way.
Contractor: Houston Contracting Co.
Project: 52 miles, 20-in., 16-in. and 8-in. from Bay Round, to Morgan City, La.
Status: Under way.
Contractor: Houston Contracting Co.

TRANSCONTINENTAL GAS PIPE LINE CORP., 3100 Travis St., Houston, Tex.
Project: 30 miles, 30-in. main-line loop, Texas.
Status: Approved.
Completion: 1961.
Contractor: Houston Contracting Co.
Project: 21 miles, 36-in. main-line loop, Mississippi.
Status: Approved.
Completion: 1961.
Contractor: C. S. Lenoir.
Project: 62 miles, 36-in. main-line loop, Alabama.
Status: Approved.
Completion: 1961.
Contractor: C. S. Lenoir.
Project: 39 miles, 36-in. main-line loop, Georgia.
Status: Approved.
Completion: 1961.
Contractor: Williams Brothers Co.
Project: 22 miles, 36-in. main-line loop, South Carolina.
Status: Approved.
Completion: 1961.
Contractor: Williams Brothers Co.
Project: 15 miles, 36-in. main-line loop, North Carolina.
Status: Approved.
Completion: 1961.
Contractor: Williams Brothers Co.
Project: 7 miles, 16-in. main-line loop, New Jersey.
Status: Approved.
Completion: 1961.
Contractor: Conduit & Foundation Construction Corp.
Project: 12-in. Delaware River Crossing.
Status: Approved.
Completion: 1961.
Contractor: American Dredging Co.
Project: 6 miles, 36-in. main-line loop, Louisiana.
Status: Ttemporary authorization.
Completion: 1961.
Project: 44 miles, 36-in. main-line loop, Mississippi.
Status: Temporary authorization.
Completion: 1961.
Project: 22 miles, 36-in. main-line loop, Alabama.
Status: Temporary authorization.
Completion: 1961.
Project: 32 miles, 36-in. main-line loop, Georgia.
Status: Temporary authorization.
Completion: 1961.
Project: 21 miles, 36-in. main-line loop, South Carolina.
Status: Temporary authorization.
Completion: 1961.
Project: 14 miles, 36-in. main-line loop, North Carolina.
Status: Temporary authorization.
Completion: 1961.
Contractor: Williams Brothers Co.
Project: 22 miles, 36-in. main-line loop, Virginia.
Status: Temporary authorization.
Completion: 1961.
Contractor: Williams Brothers Co.
Project: 26 miles, 36-in. main-line loop, Maryland.
Status: Temporary authorization.
Completion: 1961.
Project: 153 miles, 3, 8, and 20-in. purchase laterals, offshore Louisiana.
Status: Temporary authorization.
Completion: 1961.
Contractor: Brown & Root.

TRANSWESTERN PIPELINE CO., 618 First City National Bank Building, Houston 2, Tex.
Project: Gathering system in West Texas and Oklahoma, approximately 100 miles, 4 to 6 in.
Status: Under way.
Contractor: Sheehan Pipe Line Construction Co.

TRUNKLINE GAS CO., Box 1642, Houston, Tex.
Project: 9.6 miles, 30-in., Longville to Bundick, La.
Status: Pending FPC approval.
Project: 17.5 miles, 30-in., Rayville to Pioneer, La.
Status: Pending FPC approval.
Project: 22.1 miles, 30-in., Senatobia to Byhalia, Miss.
Status: Pending FPC approval.
Project: 21.6 miles, 30-in., Hinkleville, Ky., to Vienna, Ill.
Status: Pending FPC approval.
Project: 27 miles, 10-in., Merryville to Longville, La.
Status: Pending FPC approval.
Contractor: Glaser Construction Co.

PIPELINE CONSTRUCTION

Project: 35-mile, 26-in. line, Cow Island to Jennings, La.
Status: Under way.
Contractor: Sharman, Allem, Gay & Taylor Inc.

UNITED GAS PIPE LINE CO., Box 1407, Shreveport 92, La.
Project: 216-mile, 30-in., from Bayou Sale Junction, St. Mary Parish, to West Monroe Junction, Ouachita Parish, Louisiana.
Status: Temporary FPC authorization.
Completion: Dec. 29, 1961.
Contractors: Panama, Inc., and Stanley-Bledsoe Corp.
Project: 59.15 miles, 36-in. from Bastian Bay field, Plaquemines Parish, to Lirette Terrebonne Parish, Louisiana.
Status: Temporary FPC authorization.
Completion: Mar. 10, 1962.
Contractor: Panama, Inc.
Project: 40-mile, 24-in. loop on Mobile-Pensacola line.
Status: Pending FPC approval.
Project: 10.2 miles, 30-in. loop in Terrebonne and Assumption parishes, Louisiana.
Status: Pending FPC approval.
Project: 217 miles of 30-in. from St. Mary Parish to near Monroe, La.
Status: Under way.
Contractors: Panama, Inc.;Stanley-Bledsoe, Inc.
Completion: Late 1961.

WASHINGTON GAS LIGHT CO., 1100 H St., NW, Washington 5, D. C.
Project: 16 miles of 24-in. from near Alexandria, Va., to Prince Georges County, Maryland.
Status: Approved by FPC.

U. S. Miscellaneous Pipelines

MONSANTO CHEMICAL CO., 800 North Lindbergh Blvd., St. Louis 66, Mo.
Project: 25-mile lines to move petrochemicals between proposed plant at Chocolate Bayou and Texas City.
Status: Planned.

SUNOLIN CHEMICAL CO., 1608 Walnut St., Philadelphia 3, Pa.
Project: Ten 8-in. chemical lines from SunOlin's plant at Claymont, across the Delaware River to Penns Grove, N. J.
Status: Under way.
Completion: Late 1961.

TEXAS EASTERN TRANSMISSION CORP., Box 1189, Houston 1, Tex.
Project: 350 miles of 24-in. coal-slurry line to move West Virginia coal to electric companies in Pennsylvania, New York and New Jersey. (Texas Eastern is working jointly with Consolidation Coal Co., Pittsburgh, Pa.)
Status: Proposed.

U. S. DEPARTMENT OF INTERIOR, Washington, D. C.
Project: 400-mile, 4 to 10-in. crude helium line from Bushton, Kans., to Cliffside storage area near Amarillo, Tex.
Status: Planned.
Contractor: Engineering contract to Williams Brothers Co.

Canadian Crude Oil Pipelines

BLACKFOOT HILLS PIPELINES LTD., Calgary, Alta.
★ Project: Two 75-mile lines to connect Lloydminster area with Interprovincial Pipe Line at Hardesty with 4.5-mile line to carry condensate from Hardesty for blending with heavy crude.
Status: Proposed.

BRITISH COLUMBIA OIL TRANSMISSION CO., Taylor, B.C.
Project: 85-mile, small-diameter gathering system in Blueberry field with transmission line to Taylor.
Completion: December 1961.

FEDERATED PIPE LINES LTD., 304 Sixth Ave. West, Calgary, Alta., Canada.
Project: 10 miles, 4½/6⅝-in. gathering lines.
Completion: Indefinite.

HUDSON'S BAY OIL & GAS CO., LTD., 320 7th Ave., Calgary, Alta.
Project: 10 miles, 6-in., Waterton to Pincher Creek, 29.3 miles, 8-in., Pincher Creek to Carway to connect with Glacier system in U. S.
Status: Pending CNEB approval.

INTERPROVINCIAL PIPE LINE CO., Edmonton, Alta.
Project: 90-mile lateral, Hamilton, Ont., to Buffalo, N. Y.
Status: Filed with CNEB.

MATADOR PIPE LINE CORP., Denver, Colo.
Project: 175-mile line from Burke, Bottineau, and Renville counties, North Dakota, to Cromer, Man.
Status: Approved by CNEB.
Completion: Dec. 31, 1961.

PEACE RIVER OIL PIPE LINE CO. LTD., Box 130, Calgary, Alta.
Project: 161-mile, 12-in. from Kaybob area to Edmondton with 7.5-mile, 8-in. lateral to Windfall.
Status: Under way.
Completion: Late 1961.

RANGELAND PIPE LINE CO., Calgary.
Project: 111-mile line from Cessford field to Calgary.
Status: Pending approval of Alberta government.

ROYALITE OIL CO., LTD., Calgary, Alta.
Project: 26.5 mile, 8-in. Jumping Pound and Wildcat Hills absorption plants to Valley Pipe Line near Calgary.
Status: Bids called for Oct. 31.

TEXACO EXPLORATION CO., Calgary, Alta., Canada.
Project: 22.2 miles 8⅝-in. loop on Rimbey-Westrose section of existing line.
Status: Pending Alberta Conservation Board approval.

TRANS-PRAIRIE PIPELINES, LTD., 12912 125 Ave., Edmonton, Alta.
Project: 48-mile, 6⅝-in. crude line from Worsley field to connect with existing company line to Taylor, B. C.
Status: Pending provincial authorization.
Project: Expansion of gathering system in British Columbia, 40 miles, 4-in. from Taylor to Dawson Creek; 30 miles, 6-in. from Boundary Lake to Taylor. 75 miles, 8-in. from Taylor to Milligan Creek, 11 miles, 4-in. from Milligan Creek to West Beaten; and 4 miles, 8-in. near Taylor station.
Status: Under way.
Contractor: Banister Construction Co., Ltd., Edmonton.
Completion: Fall, 1961.

WESTERN PACIFIC PRODUCTS & CRUDE OIL PIPELINES, LTD., 1155 West Georgia St., Vancouver 5, B. C.
Project: 500-mile, 12-in. from Taylor, B. C., to Kamloops to connect with the Trans Mountain line to Vancouver.
Status: Under way.
Contractors: Canadian - Bechtel, north; Dutton-Williams, south.
Completion: Late 1961.

Canadian Natural Gas Pipelines

ALBERTA GAS TRUNK LINE CO., LTD., Calgary, Alta.
Project: 226 miles of 36-in. and 125 miles of 30-in., plus laterals in southern Alberta including 58 miles of 22-in. and 64 miles of 16-in. (Part of a 1,400-mile system Alberta to San Francisco.)
Contractors: Majestic Contractors, Ltd., Edmonton, haas 113 miles of 36-in. from Crowsnest Pass to Priddis, 63 miles of 30-in. from Rocky Mountain House to Cynthia, and 38 miles of 22-in. lateral to the Rimbey region. Mannix Co., Ltd., Calgary, has 113 miles of 36-in. from Priddis to Rocky Mountain House. Dutton-Williams Brothers, Ltd., Calgary, has 62 miles of 30 in. from Cynthia to near Whitecourt, Alta., as well as a 20-mile, 22-in. lateral to the Whitecourt area. Piggott Construction, Ltd., Edmonton, has 64 miles of 16-in. lateral from Crowsnest Pass to Carway, Alta., on the U. S. border.
Projects: Laterals to tie in with the above project: 15 miles of 12-in. to Buck Lake, 23 miles of 22-in. to East Calgary, 15 miles of 16-in. to Carstairs, 4 miles of 8-in. to Sarcee, and 10 miles of 10-in. built will connect Kaybob, Berland River, Lovett River, and Stolberg.
Completion: Dec. 1961.

ALBERTA NATURAL GAS CO., LTD. (Pacific Gas & Electric Co., San Francisco, and Westcoast Transmission, Calgary.)
Project: 108 miles of 36-in. from Crowsnest Pass across southeastern British Columbia to the U. S. border near Eastport, Idaho. (Part of 1,400-mile project from Alberta to San Francisco.)
Contractor: Price Poole of Canada, Ltd. (Canadian Bechtel, Inc., Toronto, is engineering manager.)
Completion: Dec. 1961.

CARTIER GAS CORP. (St. Maurice Gas Inc., and Consumers Gas Co., 19 Toronto St., Toronto.)
Project: Transmission and distribution in eastern townships and through to Quebec City in Quebec Province.
Status: Proposed.

GAS TRUNK LINE OF BRITISH COLUMBIA, LTD., Pacific Bldg., Calgary, Alta.
★ Project: 29 miles, 16-in.; 15 miles, 12-in.; 2½ miles, 6-in.; and 1 mile, 4-in.; near Blueberry, B. C.
Status: Under way.
Contractor: Majestic Contractors Ltd.
Project: 245-mile, 30-in. extension of Westcoast Transmission system from Taylor, B. C., to Fort Nelson.

MAGNA PIPELINE CO., LTD., Nanaimo, Vancouver Island, B. C.
Project: 53 miles of parallel 7-in. reinforced plastic pipe to serve Vancouver Island, B. C.
Status: Approved.
Completion: 1963.

NORTHERN ALBERTA PIPE LINES, LTD., Edmonton, Alta.
Project: 110-mile trunk line, plus gathering system, from Las La Biche, in McMurray vicinity, to Edmonton.
Status: Pending provincial approval.

SARATOGA PROCESSING CO., LTD., 406 Petroleum Building, Calgary, Alta.
Project: 67-mile gathering system (43 miles 16-in., 24 miles 4-10-in.) for Coleman, Alta., processing plant.

SASKATCHEWAN POWER CORP., Regina, Sask.
Project: 88 miles, 14-in., Hatton to Success, Sask.
Status: Under way.
Completion: Nov. 1, 1961.
Contractor: Robb Construction.
Project: 35-mile, 4 and 6-in. line, Canora to Sturgis.
Completion: 1961.

WESTCOAST TRANSMISSION CO., LTD., Calgary, Alta.
Project: 688-mile, 30-in. loop of British Columbia-Washington line.
Status: Proposed.

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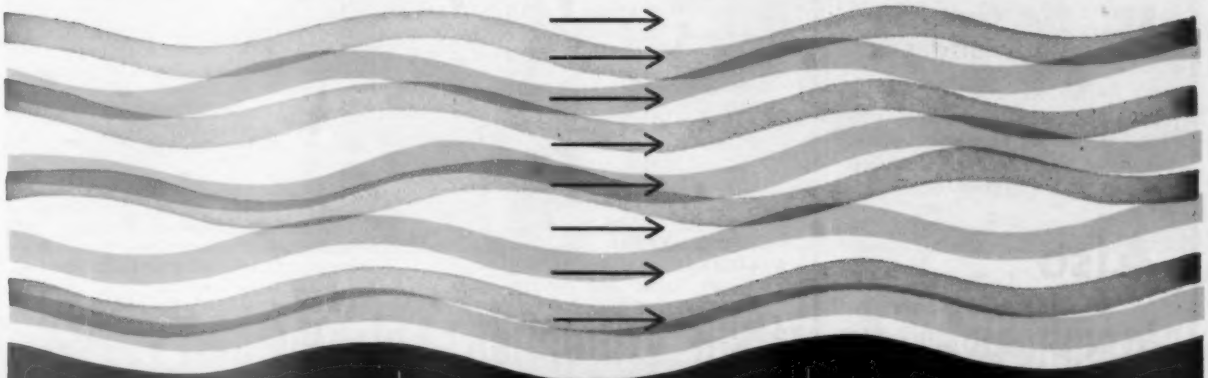

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PIPELINE CONSTRUCTION

Project: (See Alberta Natural Gas Co., Ltd., for joint project.)

Foreign Crude Oil Pipelines

ABU DHABIE MARINE AREAS, LTD. (partly owned by British Petroleum Co., Britannic House, Finsbury Circus, London E.C. 2).
Project: 20 miles of 18-in. from offshore Persian Gulf pool to Das Island.

ARABIAN AMERICAN OIL CO., 505 Park Ave., New York 22.
Project: 30-mile, 24-in. Safaniya offshore gathering line.
Status: Under way.
Completion: January 1962.
Project: 27-mile, 24-in. crude line from northern Safaniya to southern Safaniya.
Status: Planned.
Completion: Second quarter 1962.
Contractor: Aramco-Bechtel.

BASRAH PETROLEUM CO., London, England.
Project: 37-mile line from Rumalia field to power plant at Basra.
Status: Contract let.
Completion: March 1962.
Contractor: SAIPEM.

CIE. de RECHERCHE et d'EXPLOITATION PETROLIERE au SHARA, Paris.
Project: 40 miles, 4-8-in. gathering lines, El Adeb Larache field.
Status: Proposed.
Contractor: Socoman.
Completion: January 1962.

COUNCIL FOR MUTUAL ECONOMIC AID (Comecon).
Project: 2,800-mile system from the Volga-Ural oil fields in Russia to East Europe satellite countries.
Status: Construction under way in Poland, Hungary, and Czechoslovakia.

EMPRESA NACIONAL CALVO SOTELO, General Pardenas 55, Madrid, Spain.
Project: 150-mile, 14-in. Malaga to Puertollano.
Status: Planned.
Completion: 1962.

ENI, Milan, Italy.
Project: Central European System, 325 miles, 22-26-in., 300 miles, 14-18-in from Genoa, Italy, to Aigle, Switzerland, to Ulm, Germany, with branches to Ingolstadt and Stuttgart.
Status: Under way.

ENI-OMV, Vienna, Austria.
(Joint Italian and Austrian state oil agencies venture).
★ Project: 320-mile line from Trieste to Vienna.
Status: Proposed.

ESSO STANDARD LIBYA, INC., Tripoli, Libya.
★ Project: 50-mile, 20-in. line to Raguba field from terminus of existing 30-in. line from Zelten to Sirte.
Status: Planned.

IRANIAN OIL EXPLORATION & PRODUCING CO.
Project: 30 miles of 20-in. and 22 miles of 16-in. looping of Agha Jari to Bander Mashur line.
Status: Planned.

IRAQ PETROLEUM CO.
Project: Two 25-mile. 32-in. crude lines to offshore loading dock in Persian Gulf.
Status: Under way.

IRAQ PETROLEUM CO., LTD., 214 Oxford St., London W 1, England.
Project: Looping of Kirkuk-Mediterranean system 66-mile between K-1 and K-2 stations and 81-mile between K-3 toward Syria. In Syria, a 28-mile section of 30-in. is under way.

KUWAIT OIL CO., LTD., Burgan House, London, England.
Project: 31-mile, 24-in. crude line from Minagish to Ahmadi South tank farm.
Status: Planned.
Completion: Mid-1962.

MENE GRANDE OIL CO., Apartado 709, Caracas, Venezuela.
Project: 16-in. line at Block 11, Maracaibo.
Completion: December 1961.

NATIONAL IRANIAN OIL CO., Teheran, Iran.
Project: Natural gas line from Sarajeh field to Teheran.
Status: Proposed.

OASIS OIL CO. OF LIBYA, 1270 Avenue of the Americas, New York 20, N. Y.
Project: 86-mile, 30-in. from Dahra field to El Sider; 36-mile, 20-in. from Mabruk to 30-in. line.

OIL INDIA, LTD., (Burmah Oil Co. and Assam Oil Co., two-thirds, and India Government, one-third.)
Project: 720 miles in northeast India, 250 miles of 16-in. from Nahorkatiya to Noonmati and 470 miles of 14-in. from noonmati to Barauni.
Contractors: Mannesmann, Germany, and SAIPEM, Italy.
Status: 16-in. completed, 14-in. section, 1962.

PETROLEO BRASILEIRO S.A. (Brazil)
Project: 250-mile line from Rio de Janeiro to Belo Horizonte refinery site.
Status: Under consideration.
Project: 35 miles of 8 to 12-in. pipe from Buracica to Candeia.
Contractor: Techint, Inc., Milan, Italy.
Project: 80 miles of 24-in. to tie in to proposed Caxias refinery near Rio de Janeiro.
Status: Planned.

PHILLIPS PETROLEUM CO., Bartlesville, Okla.
Project: 14-in. line in Block 17, Lake Maracaibo, Venezuela.
Status: Planned.
Contractor: Chicago Bridge & Iron Co.

RHEIN-DONAU OELETUNG, G.m.b.H., Germany.
Project: Extension of South European Pipeline from Karlsruhe to Ingolstadt.
Status: Proposed.

ROYAL DUTCH-SHELL.
Project: 12-mile line from Gore Bay, Australia, to Royal Dutch-Shell's Clyde refinery.
Status: Planned.
Project: 161 miles 20-in. line from Tandzung field to Balikpapan refinery, Sumatra.
Contractor: Williams Brothers Overseas.

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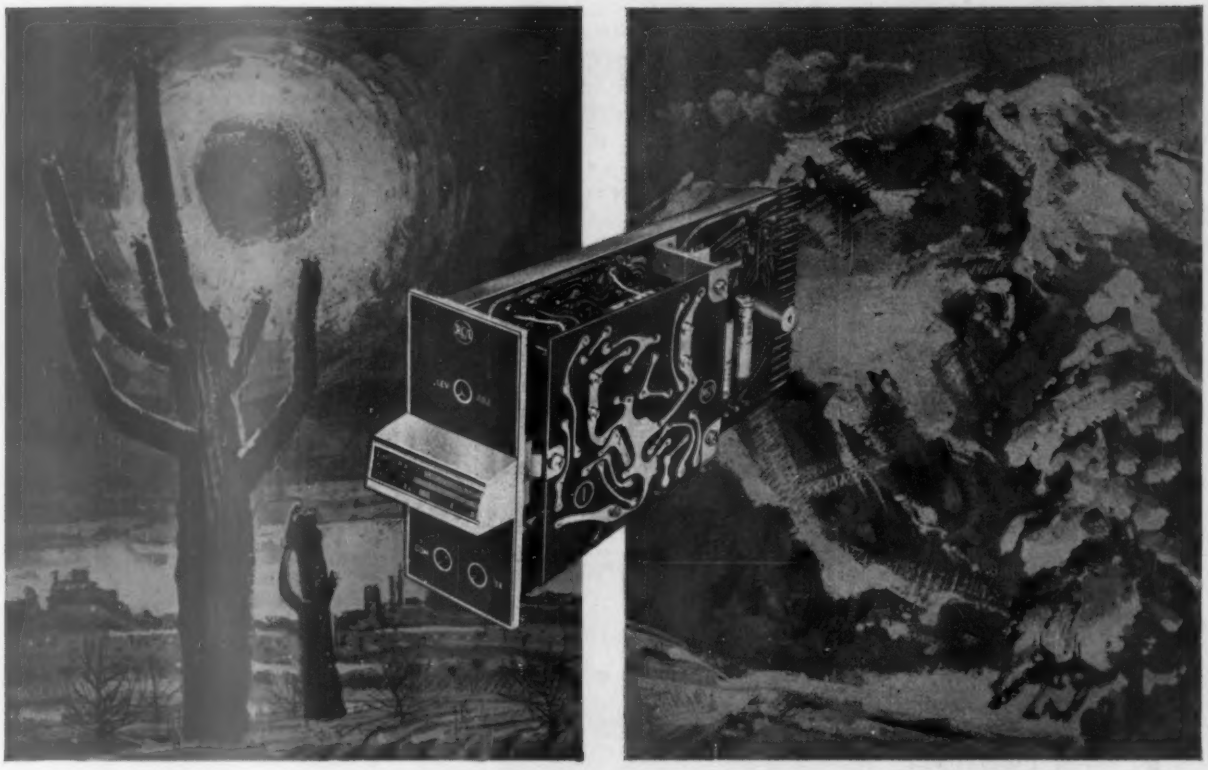

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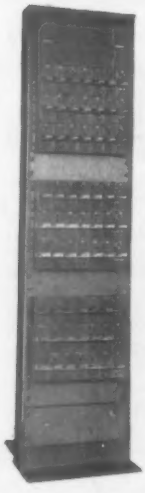

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Built-in performance assures reliability where you need it the most! Computer grade components and rugged, modular construction provide lasting dependability to not only withstand the rigors of extreme climatic changes, but also to stand up under the grind of continuous service.

For teletype, telemetering, control or data signals, each channel can be frequency-shift or AM keyed. Six transmitters or receivers in any combination may be plugged into a standard shelf that also contains a husky, regulated power supply.

24 channels from 420 to 3180 cps
Spaced every 120 cycles (CCITT Standards)
18 channels from 4300 to 7600 cps
Spaced 170 to 220 cycles
Channel units operate on 24 V DC or a 117 V AC power supply

Environmental Specifications for 100 Word-per-Minute Telegraph Service
Storage Range: —55°C to +85°C
Operating Range: —30°C to +65°C

Mail coupon for additional information

Radio Corporation of America
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RCA The Most Trusted Name in Electronics
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Congrats and $25 to Robert W. GUTEKUNST, Esso Research and Engineering Company • Post Office Box 8, Linden, New Jersey

Joe Roughneck, backbone of the oil and gas industry, sees many a truck of tough Lone Star pipe roll onto well locations from the bayous of the Gulf Coast to the plains of the Williston basin. He knows delivery will be *on time* because Lone Star pipe is stockpiled . . . in quantity . . . in the heart of the oil country.

At Lone Star, every length of API casing, tubing, and line pipe is checked and tested through each manufacturing operation to insure strength and over-all uniformity . . . your guarantee of safe, dependable service on the job.

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PIPELINE CONSTRUCTION

Ltd., Tulsa, and John Brown, Ltd., London.
Completion: January 1, 1962.

SINCLAIR VENEZUELAN OIL CO., Apartado 1706, Caracas. Venezuela.
Project: 17.35 miles, 8-in. crude line from East Aguasay to south bank of Tonoro River to connect with existing 8-in. line.
Status: Planned.
Completion: Late 1961.

SOUTH EUROPEAN PIPELINE CO. (Jersey Standard, Caltex, Shell, British Petroleum, and 12 other firms.)
Project: 419-mile, 30 in. line from Lavera, near Marseille, to Strasbourg, with 40-mile extension to Karlsruhe, Germany. This may be extended into lower Batavia with a 155-mile, 22-in. segment.
Status: Under way.
Completion: 1963.

SYRIAN GOVERNMENT, Damascus.
Project: 470-mile, 16-in. crude line from Qarah Shuk field to Mediterranean port.
Status: Proposed.

UNION OF SOVIET SOCIALIST REPUBLICS.
Project: 2,315-mile, 28-in. Trans-Siberian crude-products line from Ufa and Tuimazy fields, Bashiria, to Irkutsk.
Status: Under way.

YACIMIENTOS PETROLIFEROS FISCALES.
★ Project: 17-mile, 18-in. line from Canadon Leon to Caleta Olivia, Comodoro Rivadavia zone.
Status: Under way.
★ Project: 15.5-mile, 14-in. line from Barancas to Lujon de Cuyo refinery, Mendoza zone.
Status: Under way.

Foreign Products Pipelines

ARABIAN AMERICAN OIL CO., Dhahran, Saudi Arabia, and 505 Park Avenue, New York.
Project: 37 miles of 8-in. LPG line from Abqaik to 'Ain Dar.
Contractor: Aramco-Bechtel.
Completion: 1961.

BRITISH PETROLEUM CO., London.
Project: 12-mile, 4-6-in. from sealoading line to air terminal on Bahrain.
Contractor: Mothercat.

INDIA GOVERNMENT.
Projects: 600-mile line from Barauni to Delhi via Kanpur, Lucknow, and Allahabad; 300-mile dual crude and products line from Bombay to Bhusaval; 120-mile products line from Bombay to Poona to be extended 300 miles, later, to Hyderabad; and a 350-mile products line from Cochin to Madras via Bangalore.
Status: Proposed.

NATIONAL IRANIAN OIL CO., Tehran, Iran.
Project: 360 miles of 8-in. from Rey to Meshed, Iran.
Status: Under way.
Contractor: William Brothers, Tulsa.

PETROLEOS MEXICANOS, Avenida Juarez 92-94, Mexico City, Mexico.
Project: 350-mile, 12-in. Minatitlan to Mexico City.
Status: Planned.
Completion: December 1962.
Project: 270 miles of 8-in. from Torreon to Chihuahua.
Status: Under way.
Completion: February 1962.

PIPELINE CONSTRUCTION

PIPELINES OF PUERTO RICO, San Juan.
Project: 95 miles 8-in. from Penuelas to Catano.
Status: Approved by PSC.

SYRIAN PIPELINE.
Project: About 316 miles, 6-in. from Homs to tank farms in the Damascus, Aleppo, and Latakia areas.
Status: Under way.
Completion: 1962.
Contractor: Technit.

UNION OF SOVIET SOCIALIST REPUBLICS.
Project: 2,315 miles of 29-in. Trans-Siberian crude-products line from Ufa and Tuimazy fields in Bashira to Irkutsk.
Status: Under way.
Project: 700 miles from Novo-Kuibyshev refinery to Bryansk.
Status: Under way.

YACIMIENTOS PETROLIFEROS FISCIALES (Argentina), Buenos Aires.
Project: 652 miles of 10-in. from Lujan de Cuyo to Buenos Aires.
Status: Planned.

Foreign Natural Gas Pipelines

BRITISH GAS COUNCIL, London, England.
★ Project: Pipeline from Canvey Island terminal to Liverpool with branches to Reading and Sheffield to distribute gasified LNG from Sahara.
Status: Proposed.

GAS DEL ESTADO (Argentina), Buenos Aires.
Project: 1,050-mile line from Comodoro Rivadavia to Buenos Aires with a spur ta Plaza Huincul field in Neuquen Province. Line will be 26 in. to Plaza Huincul and 30 in. to Buenos Aires.
Contractor: Saipem-Siderexport.

GASES NATURALES DE COLOMBIA, S.A. (Owned 50% by Colombian Petroleum Co., is affiliated with Mobil International and Texaco, and 50% local.)
Project: 140 miles of 10-in. from Cicuo field to Barranquilla.
Completion: Late 1961.

INTERNATIONAL GAS CO., Los Angeles, Calif.
Project: 1,840-mile, 30-in. gas line from Reynosa to Mexicali via Monterrey, Mazatlan, etc.
Status: Proposed.

ISRAEL GOVERNMENT and private interests.
Project: 75 miles of 16-in. to power a plant at Ashdod Yam on the Mediterranean coast.
Status: Planned.

NIOGAS, Vienna, Austria.
Project: 82 miles of 8 and 10-in. to connect Traismauer and Amstetten in Austria.
Contractor: Williams Brothers, Tulsa.

PAKISTAN INDUSTRIAL DEVELOPMENT CORP.
Project: 1,000-mile system from Sui field to Lyallpur, Lahore, Daudkhel, Islamabad, Rawalpindi, and Wah. This would require a loop to an existing 310-mile 16-in. line from the Pakistan petroleum field to Multan.
Status: Proposed.

PAKISTAN PETROLEUM CO.
Project: 145 miles of 8-in. from Sylhet

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Oil and gas men are as exacting in pipe quality and dependability as a fashionable woman is in the fine needlework of her apparel or craftsmanship of her jewelry.

Lone Star men are more than steel-workers . . . they are accomplished craftsmen and they make Lone Star casing, tubing and line pipe with the same pride exemplified by a custom jewelist. Lone Star pipe has the quality, the stamina and the finish specified by API.

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PIPELINE CONSTRUCTION

field to Daccq, East Pakistan.
Status: Proposed.

PETROLEOS MEXICANOS, Avenida Juarez 92-94, Mexico City, Mexico.
Project: 270 miles of 12-in. from Torreon to Chihuahua.
Status: Under way.
Completion: December 1961.

STANDARD - VACUUM OIL CO., New York.
Project: 60 miles of 10-in. from Radja field to Palembang, Sumatra, to supply fertilizer plant planned by the government.
Status: Planned.
Completion: 1962.

SYRIAN LINE.
Project: 316 miles of 6-in. from Homs refinery to Damascus, Aleppo and Latakia.
Status: Under way.
Contractor: Techint, Inc., Milan, Italy.
Completion: Late 1962.

TEIKOKU OIL CO. and **TOKYO GAS CO.**
Project: 200-mile, 12-in. system from Kubiki gas field.
Status: Proposed.

TRINIDAD & TOBAGO ELECTRICITY COMMISSION, Port - of - Spain, Trinidad.
Project: 42-mile, 16-in. gas line from Penal fields to Port-or-Spain.
Status: Planned for 1962.

TENNESSEE GAS TRANSMISSION CO., Box 2511, Houston, Tex.
Project: 1,100-mile, 30-in. line from Reynosa, to San Luis Rio Colorado, near the California border.
Status: Pending FPC, California PUC approval.

UNION OF SOVIET SOCIALIST REPUBLICS.
Project: New line from gas fields in western Ukraine to the Polish border.
Status: USSR has signed agreement with Poland.

Project: 250-mile line from Ust-Vilyuisk field to the Siberian cities of Yakutsk and Pokrovsk, plus feeder lines to supply villages in the Lena River Valley.
Status: Planned.
Completion: Date not set yet.

Project: Two parallel, 40-in. lines, each over 1,300 miles long, from Gazli, near Bukhara, northward to Sverdlovsk and Chelyabinsk.
Status: Planned.

Project: From Tashkent to Chimkent, Dzhambul, Frunze and Alma-Ata near Chinese border.
Completion: By 1965.

Project: Line from Berezovo field southward to Sverdlovsk.
Status: Proposed.

Project: Line from Minsk northward to Baltic Sea area.
Completion: To Vilnius, Lithuania, in 1961; to Riga, Latvia, in 1962.

Project: Line from Minsk northeast to Leningrad.
Status: Proposed.

Project: 800-mile, 40-in. line from Krasnodar fields north of Caucasus Mountainsto Serpukhov, south of Moscow, via Rostov and Lugansk.
Status: Under way.

Project: 310 miles of 32-in. line ringing Moscow at radius of about 50 miles.
Status: Under way.
Completion: 1962.

SPECIFICATION
PIPE LINE PROTECTION
MATERIALS
with Good Service at Competitive Prices

- Asbestos Felt and Rock Shield
- Glass Pipeline Wraps
  Mfd. by Owens-Corning Fiberglas Corp.
- Tapes
- Kraft Wraps
- Casing Seals
  Mfd. by Irish Pipe Line Supply Co.
- Alpon Internal Pipe Coating
  (Epoxy Coating)
- Tar-Clad
  (Coal Tar Epoxy Coating)

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Representing a cross-section of both large and small firms in a variety of enterprises, the book gives a "shirt-sleeves" approach to such factors as staff—getting the most from your time—incentives—promoting innovation—planning—securities markets—*and more.* It explores also executive responsibilities in sales, production, finance, research, personnel, and other key aspects . . . and the tasks of activity-area managers for these functions.

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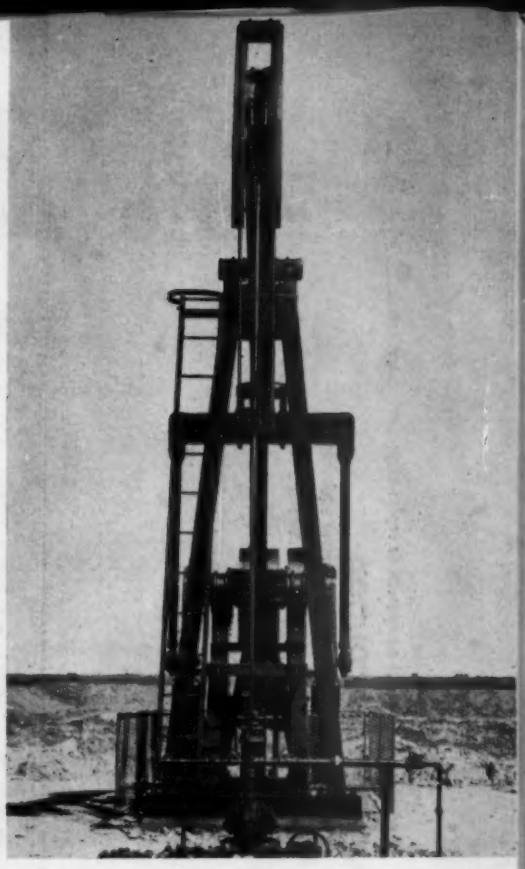

Heavy-duty performance with SERIES "60" compact design

EVERY POUND IS A WORKING POUND Every pound in the structure of Bethlehem's Series "60" contributes to its working strength. There's the real secret of this unit's heavy-duty performance: its truss design achieves maximum torque and well-load capacity per unit of weight.

MAXIMUM RIGIDITY AND STRENGTH TO WEIGHT RATIOS It's a strong, rigid structure because its new truss construction holds it steady through years of capacity pumping.

COMPACT, EASY TO SERVICE With unnecessary weight pared off, the "60" is easy to erect, easy to move. And it has many features that require less servicing than ever before.

ADVANCED DESIGN TRIMS OPERATING COSTS The Series "60" is new from the base up—new reducer, sealed bearings, structurals, cranks, equalizer, servicing features. All are designed to cut operating costs and improve performance.

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Please send me your new Booklet 1669, introducing the Bethlehem Series "60" pumping unit.

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Described in OIL AND GAS JOURNAL -issue of November 27, 1961
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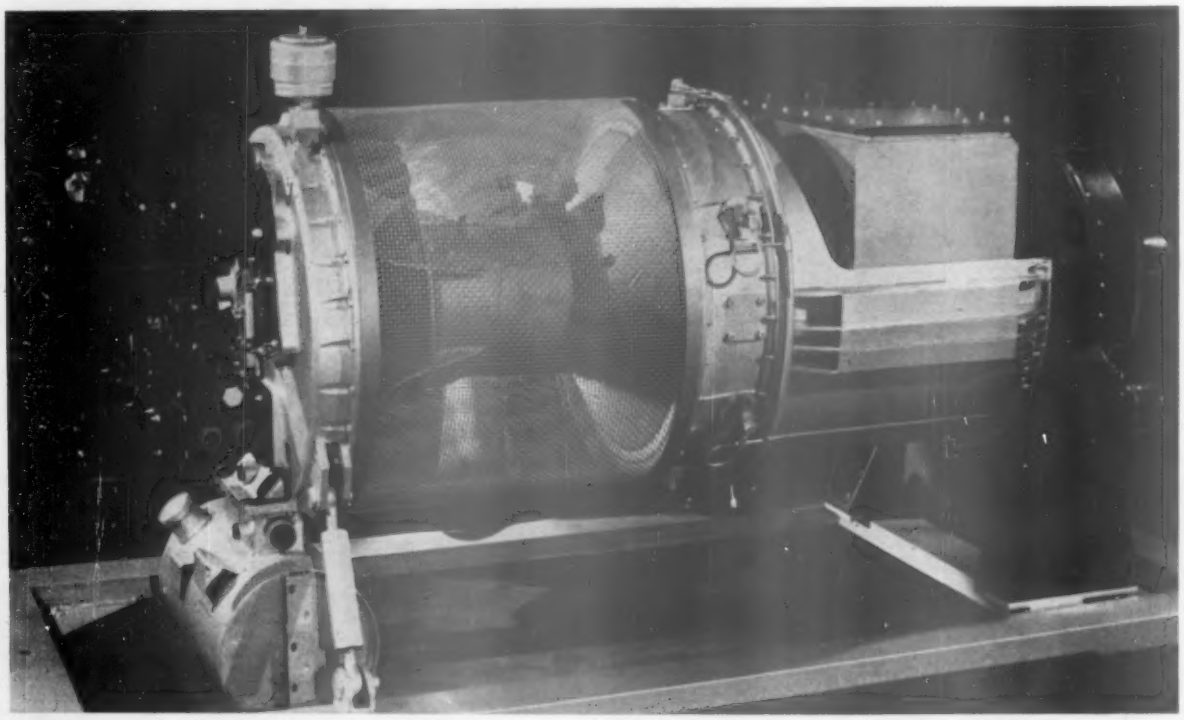
Kit for testing motor oil

ACCORDING TO THE MAKER of this simplex portable motor-oil testing kit, the kit speeds oil-testing processes, makes the job easy and clean, and increases accuracy, compared with older methods. In less than 5 minutes you can make tests and read the results.

Designed to test oil from various types of engines, the kit is used to check oil in the field, on the job, overnight, and wherever accurate, fast test results are needed. The maker claims the kit will save you money in annual engine-maintenance costs by providing oil analysis that tells the precise moment to change oil and filter, giving clues to the internal condition of the engine, and reducing down time. Source: **Lengor, Inc.,** Box 126, Annapolis, Md.



Multiple-fuel 500-hp. gas turbine to power drilling rig

THIS LN 50 turbine will be put into operation later this year. Coupled with a d.c. generator on a portable skid, it will supply electrical power for drilling-rig components.

Other promising applications include drilling standby and continuous-duty generator, and pipeline and other pumps and compressors. Uses are also being studied in which the engine's exhaust heat would be recovered to produce steam for

Mr. Drilling Contractor

Your Pressure Worries Are Over!

Goodall proudly announces
two ALL-NEW rotary hose
S-7500 Super Long-Life
...and the revolutionary
S-10,000 ULTRA Long-Life

Goodall, first with every worthwhile rotary hose development, now puts an end to your pressure worries with two completely new types of hose. You've heard about this amazing hose from your friends. Now, with complete performance data and a full supply of hose, we can offer Goodall S-7500 Super Long-Life and S-10,000 ULTRA Long-Life Rotary Hose for sale through your supply store.

Goodall S-7500 Super Long-Life is a premium cable hose at the regular price. It is **the** rotary hose for working pressures up to 4000 lbs.

For working pressures above 4000 lbs., you need the new ULTRA Long-Life hose. It costs more to make, it costs more to buy—but it's worth every penny. Supply is limited; please order ULTRA Long-Life cable hose in advance of your needs. Available in 3" hose sizes only.

These new Goodall rotary hose are products of years of research and equipment development. Manufactured with completely new machines, they are masterpieces of perfect balance. The type of cables, the angle of the cables, gasket materials, weight of couplings—all are new.

Now you can use the high pressure capacity of your pumps, or conform to oil company test procedures, without a worry about exceeding the rotary hose working pressure. And, because these hose have substantially more reserve strength, they give you **bonus longer life.**

You always get the advantages of the Goodall unconditional one-year guarantee, the famous Barney Coupling, the Goodall Safety Clamp and the Goodall Repair Service. Call your favorite supply store and specify Goodall!

Goodall has been first with every worthwhile rotary hose development

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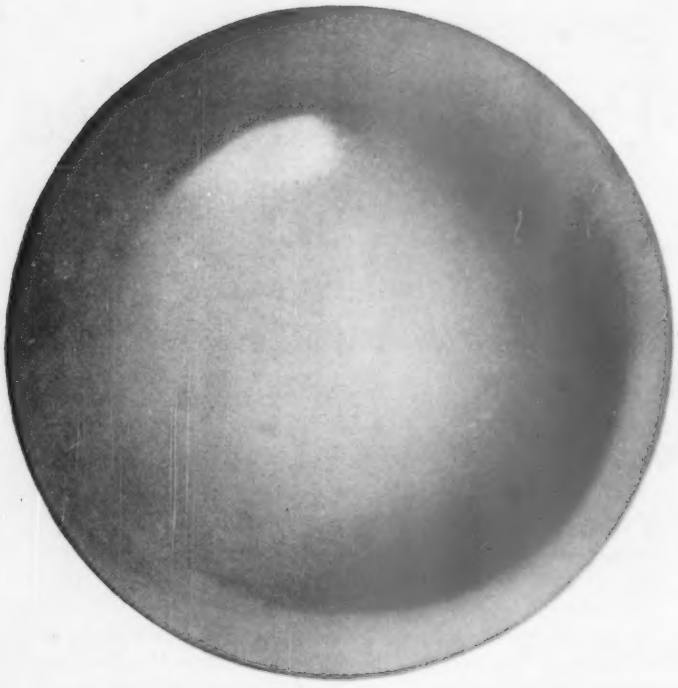
A TRIBUTE TO BARNEY

On the occasion of the introduction of this great hose, Goodall Rubber Company gratefully salutes H. "Barney" Barnard for more than a quarter-century of dedicated effort to industry-wide rotary hose improvement.



DuMore Balls and Seats

Best in the Oil Patch for Hard Pumping

DuMore is an exceedingly hard alloy composition of chromium, cobalt, and tungsten, a combination of metallurgical properties that is comparable to tungsten carbide—the hardest metal in commercial use today. DuMore Balls and Seats will withstand sand-cutting, ball-pounding, magnetism, high temperature, impact, lodestone, pressure, and the effects of any known corrosive well fluids. Try DuMore the next time you set a pump in a troublesome, hard-to-pump well. You'll be more than satisfied with the service you'll get, and you'll like the way DuMore will reduce those frequent pulling jobs, too.

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HF

"BEST PUMPS IN THE OIL PATCH"

processing, heating, or cooling. The 1,000-lb. turbine weighs less than one-tenth as much as piston engines of similar power rating, according to the manufacturer.

The unit is a simple-cycle, 2-shaft gas turbine capable of operating on various liquid fuels or natural gas. Major engine components are a gas generator, consisting of a compressor, combustor and turbine, and an aft-mounted power turbine that converts heat energy in the exhaust from the gas-generator section into mechanical power.

The power turbine, also single-stage, transmits power to the output shaft through two steps of speed reduction. It may be operated at either a fixed or a variable speed, depending upon requirements. Source: **General Electric Co.,** Schenectady 5, N. Y.

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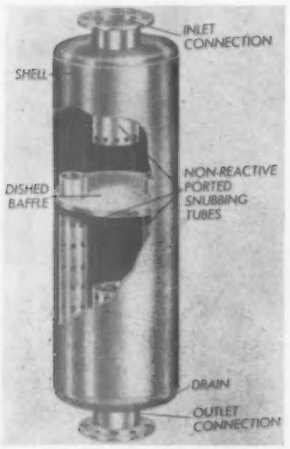
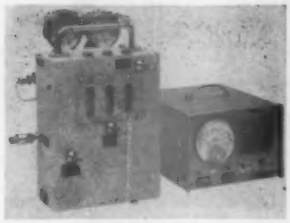


New intake snubber

Just developed is this intake snubber for use with positive-displacement blowers, reciprocating compressors, and gas and diesel engines. Known as the BMI, the snubber has been specifically designed for intake service in which the flow of intake air passes through snubbing chambers containing an arrangement of nonreactive ported tubes. This arrangement attenuates intake noise to a smooth, quiet flow.

The snubber reduces airborne vibration with minimum restriction to flow, the maker claims. Treated internally to prevent rust, the snubber comes in 8 through 30-in. pipe sizes. Source: **Burgess - Manning Co.,** 9207 Sovereign Row, Dallas, Tex.



High-pressure moisture analyzer

The moisture content of gas at pressures to 10,000 psig. can be measured with a new electrolytic type of moisture analyzer. The Model W, Type HP analyzer includes all necessary components for accurate high-pressure moisture measurements. The sample module is explosionproof and includes a thermostat to maintain stability.

Appropriate flowmeters and pressure gages indicate gas flow and pressure of the sample. An oil mist separator with a continuous oil dump minimizes cell contamination. Source: **Manufacturers Engineering & Equipment Corp.,** Hatboro, Pa.

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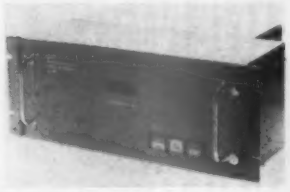

Pipeline data-telemetering system

This new digital data-transmission system for the remote display and recording of information from various types of meters on pipelines is now available. Known as the Datex SD-102 accumulated-count data-transmission system, it makes it possible to record in one central location flow data from a number of points along gas, oil, and water pipelines. Transmission can be over commercial telephone lines or over private channels.

The system is self-synchronizing and self-checking, with data transmitted as a six-character, decimal-digit message. Readout may be obtained on demand or programed automatically. The system consists of a receiver and a printer (central office) and any number of transmitters (remote locations). Source: **Datex Corp.,** 1307 S. Myrtle Ave., Monrovia, Calif.

Latest preformed aluminum end caps

Designed to speed insulating and covering of pipelines, these new end caps can also be used to fit where insulation stops at valves, flanges, and unions. According to the maker, use of the end cap eliminates beveling of insulation and waterproofing the end of the insulation with mastic or other materials. Formed from aluminum, the caps are made in two halves and extend up over the straight pipe for 2 in.

This overlap is designed to provide a watertight seal with the jacketing on the straight pipe sections. The end caps are protected from corrosion by a sprayed and baked epoxy moisture barrier. Source: **Premetco,** Box 1134, Shreveport, La.

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TYPE 30 — Carbon-Manganese fully normalized. For heavy duty where corrosion is not a major problem.

TYPE 75 — Nickel-Chromium-Molybdenum Steel, normalized and tempered. For extremely heavy duty in medium corrosive fluids.

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Left on sucker rods, mill scale often becomes imbedded in the rod's surface when upsets are forged. There it is a target for corrosion attack and stress concentration, which cause premature rod failures.
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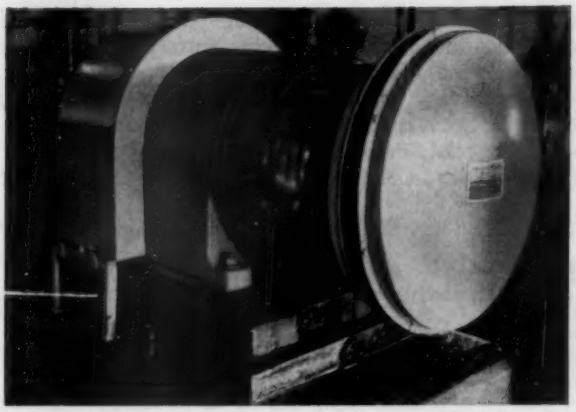
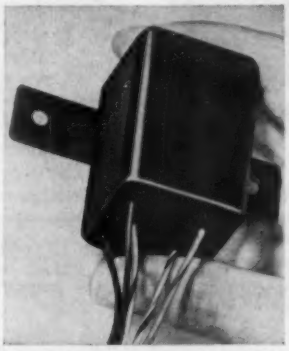


Mute for quiet motor operation

DESIGNED for lessening noises caused by electric motors used principally in refineries and petrochemical plants are these Pulsco Motor Mutes. Installation of the device on the air inlet of an electric motor reportedly streamlines and improves air flow to the suction of the cooling fan. As a result, the device actually improves the flow of cooling air and reduces pressure drops, the maker claims.

Over-all sound-pressure level can be reduced to 80-86 db. at 100 ft. when properly installed.

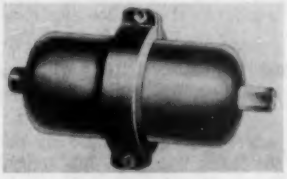
The Mutes have been successfully applied to all types of totally enclosed fan-cooled motors, including double-shell and ribbed open-case designs. It can be applied to either horizontal or vertical motors, to open motors, and to vertical pumps. Source: **Pulsation Controls Corp.,** Box 169, Santa Paula, Calif.



Electronic control for engine starters

A new transistor-controlled time-delay relay for use on starter mechanisms of internal-combustion engines, said to be especially suitable for stationary power units, has been placed on the market. The relay was designed to eliminate the factor of human error in operating the oil-pressure switch on engines.

Connected in series with the magneto and oil-pressure switch, the relays allow oil pressure to build up with the engine running by bypassing the oil-pressure switch for about 30 seconds. At the end of the time delay, the relay automatically closes, allowing the oil-pressure switch to take over. Source: **Accutronics, Inc.,** 403 N. Foothill Rd., Beverly Hills, Calif.



Newly designed accumulator

Two new design features in this manufacturer's hydraulic accumulator have been made obtainable. A polyurethane diaphragm is used in place of the rubber one. It is three times as strong, and has greater chemical and temperature resistance (−80° to 250° F.). The added strength and flexibility of this material allows elimination of the guide spring and removal of the retainer plate from the diaphragm, the maker claims.

The plate is integrated into a nonfouling, two-way, spring-loaded retainer at the outlet, allowing greater diaphragm travel and clean-

ing ease. Other features cited by the manufacturer include increased diaphragm life, elimination of failure through overcharge, easy maintenance, increased capacity, and versatility. Source: **Special Products Co.,** Box 592e, Golden, Colo.

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Pipewrap adhesive tape of polyethylene

This new 20-mil, pressure-sensitive, polyethylene pipe-wrap adhesive tape, designed for use as a protective coating on pipes, conduit, or other surfaces, has been placed on the market.

The tape's thickness combines a 16-mil film with a 4-mil adhesive, and its adhesion is 40-oz. per in.-width. It has a tensile strength of 35-lb. per in.-width and its moisture-vapor transmission rate is 0.18 g. per 100 sq. in. in 24 hours. Dielectric strength is 1,000 volts per meter and insulation resistance is 1,000,000 megohms. Source: **Arno Adhesive Tapes, Inc.,** 4170 Ohio St., Michigan City, Ind.

The Remuda KD-1250 Donkey is a small but extremely rugged 2" x 2½" Horizontal Simplex Pump designed for high pressure requirements such as those encountered in water disposal and oil pipeline gathering systems.

If you're tired of buying more pump than you need in order to get the pressure and volume you need, just note these figures:

Maximum capacity — **408 BPD** at 870 psi with 2" plunger.
Maximum pressure — 102 BPD at **3500 psi** with 1" plunger.
Net weight — **161 pounds.**

Besides its compactness and stamina, the Donkey is completely versatile. Five plunger sizes are available from 1" through 2" to insure the correct size for your requirement. Standard plungers are of 316 stainless steel alloy plus an optional colmonoy plunger and the fluid end of the pump is offered in aluminum-bronze (standard) or 316 stainless steel.

The Donkey has been thoroughly proven in the field and has shown itself to be tough enough to withstand any abuse which might be encountered in all services for which it is intended.

For a detailed description of the Donkey and other quality Remuda Pumps, write

"MORE PUMP PER POUND"
REMUDA PRODUCTS CO.
P. O. BOX 715 • WICHITA FALLS, TEXAS • PHONE 322-4212

New propping agent

Called Tuf - Prop Tru - Rounded walnut shell, this new propping agent for increased fracture capacity is claimed to be a genuinely rounded product. The maker claims that field applications have shown that carrying capacities of hydraulically induced fractures can be increased in many cases through the use of rounded walnut shells as propping agents.

Source: **Cherokee Laboratories, Inc.,** 3021 Sand Springs Rd., Tulsa 7, Okla.

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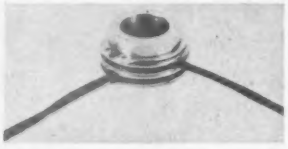

Force washers

Actually miniature load cells, the LEC temperature-compensated force washers approximate the shape of regular bolt washers. Compensated for temperatures of 50° to 250° F., they come in conventional bolt sizes ranging from 3/16 to 1-in. in diameter. Loads for these diameters range from 5,000 to 35,000 lb., depending on bolt diameter selected. Source: **Avionics & Industrial Products Div., Lockheed Electronics Co.,** 6201 E. Randolph St., Los Angeles 22, Calif.

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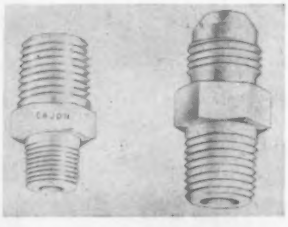
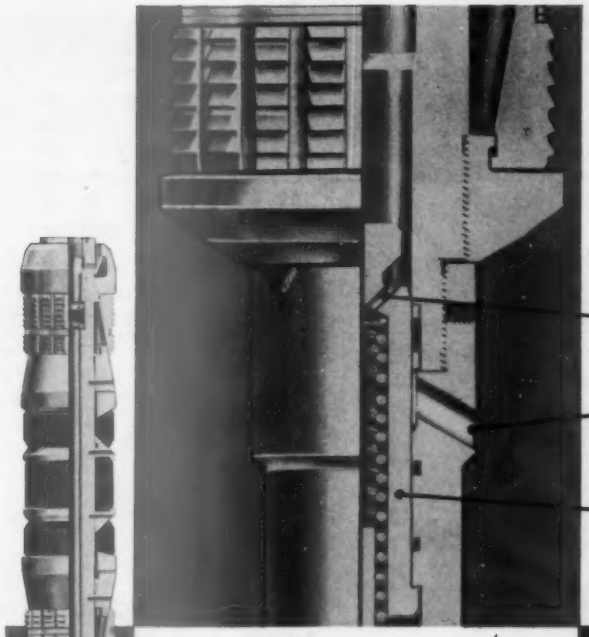


Plastic pipe fittings

These pipe fittings are available in the following plastics: Zytel (nylon), Teflon, PVC, Profax, polyethylene, Plaskon, Penton, Kel-F, and Delrin. Obtainable in a range of shapes and sizes from 1/16 through 1-in nominal pipe size, the fittings promise to solve problems of corrosion, chemical reaction, leakage in vacuum lines, electrical insulation, and weight reduction. Source: **Cajon Co.,** 902 E. 140th St., Cleveland 10, Ohio.



SV DC
Squeeze Packer
and
Circulating Valve

HALLIBURTON PRESENTS THE SV DC

ANOTHER IMPROVEMENT IN SQU... PACK... DESIG...

SV DC PROVIDES OPERATING VERSATILITY

The Sliding Valve in the Halliburton drillable cast iron SV DC Squeeze Packer provides unique benefits before, during, and after the squeeze job. The pressure balanced sliding valve may be opened or closed *at will* any time simply by raising or lowering the tubing. This permits flow-through of well fluids during run-in on tubing; pressuring-up above or below the packer for testing packer seat and tubing; circulation; squeezing; and reversing out excess cement.

EXCLUSIVE Sliding Valve Features:

★ Pressure balanced sliding valve can only be opened or closed *mechanically* by raising or lowering tubing. The pressure balanced port in the valve equalizes pressure across the valve to permit effective holding of pressure from either direction.

★ Mechanical operation of the sliding valve eliminates necessity of dropping or pumping down sealing ball or plug for shut-off.

★ When Circulating Valve is lifted out of tool, the closed sliding valve holds annulus fluid load off weak formations below the packer.

★ Pressure below packer can be released if desired by lowering tubing.

★ Closing valve by lifting tubing a short distance permits testing of tubing under pressure from top to bottom of string without the aid of another device.

These advanced SV DC Packers are available now in most popular casing and packer O.D. sizes . . . with other sizes under development.

OTHER FEATURES

★ Forms an effective fluid tight drillable casing packer, for squeezing cement below through tubing or drill pipe.

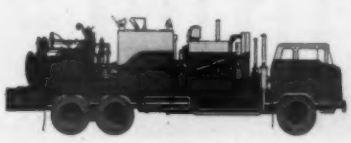
★ Constructed of high strength cast iron material and rubber seal elements, for general use in any well, as a temporary or permanent bridge plug, regardless of depth and pressure.

★ Packer is set with circulating valve setting tool by mechanical rotation of tubing or drill pipe — or by hydraulic setting tool on sand line or electrical wireline setting tools.

Halliburton has developed tools for every cementing need . . . call Halliburton for dependable cementing of your wells.

275 Service Centers . . . just minutes away from your well

CEMENTING SERVICES



Halliburton
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TRADE LITERATURE

Direct-contact gas heating

Literature on a new development, the engineered application of electric heat to the direct-contact heating of gases, is now available. Bulletin 302.1 (four pages) describes features of the Radi-fin design, developed for heating gases to 1,800° F. in such applications as high temperature and/or high-pressure process reactions. One page is devoted to a "kilowatt requirement" chart for determining the kilowatt rating needed to heat a gas through a given temperature differential where flow rate and specific gas heat are known. Source: **Hynes Electric Heating Co.,** 708 Colfax Ave., Kenilworth, N. J.

Weigh small samples

A new-four-page bulletin outlines the Cahn Gram Electrobalance, an instrument designed to weigh small samples easily, quickly, and accurately. The literature lists the instrument's performance, including precision and accuracy. One full page deals with principles and features of electromagnetic weighing. Source: **Cahn Instrument Co.,** 14511 Paramount Blvd., Paramount, Calif.

Turbine flow meters

This 12-page technical bulletin, obtainable free, describes a broad line of turbine flowmeters for liquids, gases, and cryogenics. The flow meters are used to measure flow rate and total flow, and for automatic process control in batching and blending systems. Technical data supplied in Bulletin 1384-C includes ranges, accuracies, frequency outputs, accessory equipment, calibration procedures, photographs, charts, and 39 illustrations. Source: **Cox Instruments Div., George L. Nankervis Co.,** 15300 Fullerton Ave., Detroit 27, Mich.

Centrifugal pump with glass parts

For highly corrosive pumping jobs involving relatively small capacities—up to 75 g.p.m., a 1-in. glassed pump has been made available, according to Bulletin 725.3. The four-page literature reports that glass, fused to metal, on all surfaces coming in contact with the pumpage, provides resistance to corrosion, eliminates contamination of product, and adherence of product to pump parts. The bulletin gives construction details, performance curves, and dimensions of the pump. Source: **Goulds Pumps, Inc.,** 229 Black Brook Rd., Seneca Falls, N. Y.

Packaged air compressors

This 4-page publication covers the design, operation, and features of three new packaged air compressors. It cites the output of one of the compressor units as up to 1,550 cu. ft. per minute at a discharge pressure ranging from 0 to 500 psi., 1,450 cu. ft. per minute, to 800 psi., and 1,180 cu. ft. per minute at 1,250 psi. The literature piece provides a performance curve showing discharge pressure at capacity cubic-feet-per-minute, 12 psi. at 5,500 ft. above sea level. Source: **Magcobar Mud Co., Inc.,** Petroleum Club Bldg., Denver, Colo.

"Triple Threat"
TO SUCKER ROD FATIGUE
1. JONES SUCKER RODS
2. JONES UNDERCUT PINS
3. JONES ROLLED THREADS
1
Rolled threads are stronger at the point where most pin failures originate . . . steel fibers and grain are rearranged to follow the thread contour, providing a dense structure at the critical thread root. Sucker rods with rolled threads make up tighter and stay tight because there are no high spots to beat down and cause the joint to loosen.
Undercutting the pin shank further increases fatigue resistance by eliminating the run-out thread and improving the elasticity of the joint.
Ask your Jones representative for further information on the "Triple Threat".
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2
3
JONES
SUCKER RODS

EQUIPMENT MEN

Western Geophysical executive presents gift to fight communism

Henry Salvatori

Henry Salvatori, founder and chairman of the board of Western Geophysical Co., subsidiary of Litton Industries, Inc., has presented a gift of $325,000 to the University of Southern California, which will be used to establish a research institute on communist strategy and propaganda.

The institute will be a part of USC's school of international relations, which was founded by USC's Chancellor Rufus B. von KleinSmid in 1924. The Salvatori gift provides for both the institute and a strengthening of related programs within the school.

Pittsburgh Steel Co. makes four sales and service assignments

George W. Novak, of Pittsburgh Steel's Mid-Continent district headquarters at Houston, has been named oil-country engineer, a new post established to give the operating department full-time representation with oil-producing companies and drilling contractors. Jewel D. Smith, of the Tulsa district office, has been named sales representative for all company products in the Tulsa territory.

Robert E. Lauterbach, vice president of sales, also announced the appointment of Ernest G. Griffin, Jr. as sales service field engineer in the Tulsa territory, and James D. Sutton as salesman in the Houston sales district.

Daniel Orifice Fitting Co. names R. H. Clemons, Jr. as sales mgr.

In this capacity, Clemons will be responsible for all Daniel sales activities, both locally and internationally, through seven district sales offices and 18 manufacturers' representatives. A 12-year veteran with the firm, Clemons joined Daniel as a sales representative in Los Angeles.

He transferred to Philadelphia in 1951 and served there as eastern factory representative until 1956. At that time he moved to Houston to become assistant to the sales manager.

Wunder named representative for Darling Valve & Mfg. Co.

Alfred E. Wunder has been appointed a district sales representative of Darling Valve & Mfg. Co., Williamsport, Pa. With headquarters in Cincinnati, Wunder will be in charge of all activities involved in selling the company's line of gate, check, and butterfly valves. Wunder was formerly with McGraw Construction Co.

George Elsey named assistant to the president at M. W. Kellogg

Elsey will be located in Kellogg's new Washington, D. C. office and will be concerned primarily with long-range-company planning. He was formerly with the American Red Cross for 8 years, serving as vice president responsible for international activities.

Before that he served for 6 years in the executive office of the president of the United States. Elsey was administrative assistant to President Truman and, as an associate of W. Averell Harriman, helped administer the government's foreign-assistance programs.

Allis-Chalmers Mfg. Co. names rotary-compressor distributor

Superior Iron Works & Supply Co., Inc., of Shreveport, has been appointed distributor for Allis-Chalmers rotary compressors in Louisiana, Texas, Oklahoma, Mississippi, and Arkansas. The Shreveport firm was organized in 1918 and is headed by R. D. Poindexter. C. B. Watson is treasurer and V. J. Martzell is sales manager.

Walworth sales, marketing unit names management executives

W. Frederick Spence, chief executive officer and board chairman of Walworth Co., has announced the following executive appointments for its newly created Walworth-Grove-Aloyco Sales Division. Under new Walworth President John W. Collins,

INTERNATIONAL AND OUT-OF-TOWN GUESTS at the November meeting of the New York Chapter of Nomads were, seated, left to right: W. H. Cotter, Bahrain Petroleum Co., Ltd., Bahrain; Glen A. Tableman, visiting Nomad from Houston; W. H. Porth, visiting Nomad from Milwaukee; A. van den Heuvel, Asiatic Petroleum Corp., New York, formerly in Indonesia; and Frank Eijkhout, Shell Trinidad Ltd., Trinidad, W.I. Standing, from left, are: Ken Nicolson, American Overseas Petroleum (Spain), Ltd., Las Palmas, Canary Islands; Ben West, Cummins Diesel International, Ltd., Buenos Aires, Argentina; and Ashley Moore, Mobil Oil Co., Ltd., Zurich, Switzerland.

who will head the sales and marketing division, Hellmuth Strauss has been named senior vice president.

B. J. Hancock has been named vice president of field sales. He previously filled the same position for Grove Valve & Regulator Co., a Walworth subsidiary. Newton Ewalt will continue as vice president of power plant and project sales in the New York office, with the additional responsibilities of assisting the coordinator of marketing and sales.

G. A. Hoffman, vice president of sales distribution for Walworth, will supervise all major accounts in New York. Clyde W. Cook has been named vice president, director of lubricated plug valve production, headquartered in East St. Louis, Ill. Coordinator of marketing and sales is K. F. Williamson.

Manning, Maxwell & Moore names Murphy to top sales post

Succeeding A. W. Coleman who has retired, F. James Murphy has been named general sales manager of the Gauge & Instrument Division of Manning, Maxwell & Moore, Inc. Murphy joined the company as a sales engineer in Pittsburgh in 1949. Subsequent positions included product manager and assistant general sales manager.

Thomas G. Schoolcraft named district manager at Denver

T. G. Schoolcraft

The appointment of Thomas G. Schoolcraft as district manager at Denver for Oil Well Supply Division of U. S. Steel Corp. has been announced by R. L. Armstrong, the division's Rocky Mountain area manager. A 32-year veteran with Oil Well Supply, Schoolcraft has been serving as district merchandise manager since 1951.

Another division assignment was announced by Mark Barkhurst, Mid-Continent area manager. James R. Harris takes over as field representative at Ponca City, Okla. Harris has been serving as district representative in Oklahoma City since last May.

Jones & Laughlin Supply Div. appoints three new managers

C. E. Bogle

Appointment of three managers within J&L's field and general office organization was made by W. L. Wolfe, vice president in charge of sales. C. E. Bogle, manager of the drilling-equipment section at Tulsa, has been promoted to manager of the Rocky Mountain region. He will head-

C. H. Maxwell

H. L. Shackelford

quarter in Denver where he will direct the activity of offices and stores in Colorado, Wyoming, Montana, North Dakota, and western New Mexico.

C. H. Maxwell, district sales manager at San Antonio, has been advanced to manager of the drilling-equipment section at Tulsa, succeeding Bogle. H. Leon Shackelford, sales at Denver, has been promoted to city sales manager at the same location.

Ernest F. Upton Jr., is appointed to engineering executive post

Ernest F. Upton, Jr. has been named director of engineering by Fischer & Porter Co., manufacturers of industrial process controls and data-processing equipment. He was formerly engineering director of the Weston Instruments Division of Daystrom, Inc., Poughkeepsie, N. Y.

Strang named sales manager of Borg-Warner Mechanical Seals

David F. Strang's appointment was announced by H. E. Tracy, general manager of the Borg-Warner division. Strang has been with Borg-Warner Seals since its formation, serving in various sales capacities, as regional manager, and later as assistant sales manager. He will continue to headquarter in Houston.

Beckman makes 2 appointments

The appointments of James E. Tebay as eastern regional sales manager and R. Pat Connor as western regional sales manager — process instruments for the Scientific & Process Instruments Division of Beckman Instruments, Inc., has been announced by Roy F. Brown, marketing manager for the division.

A Beckman employe since 1956, Tebay was formerly training manager for the division and has also held positions on the division's sales staff. He will be based at Mountainside, N. J. Connor, formerly a division sales engineer, will locate at the Beckman headquarters in Fullerton, Calif.

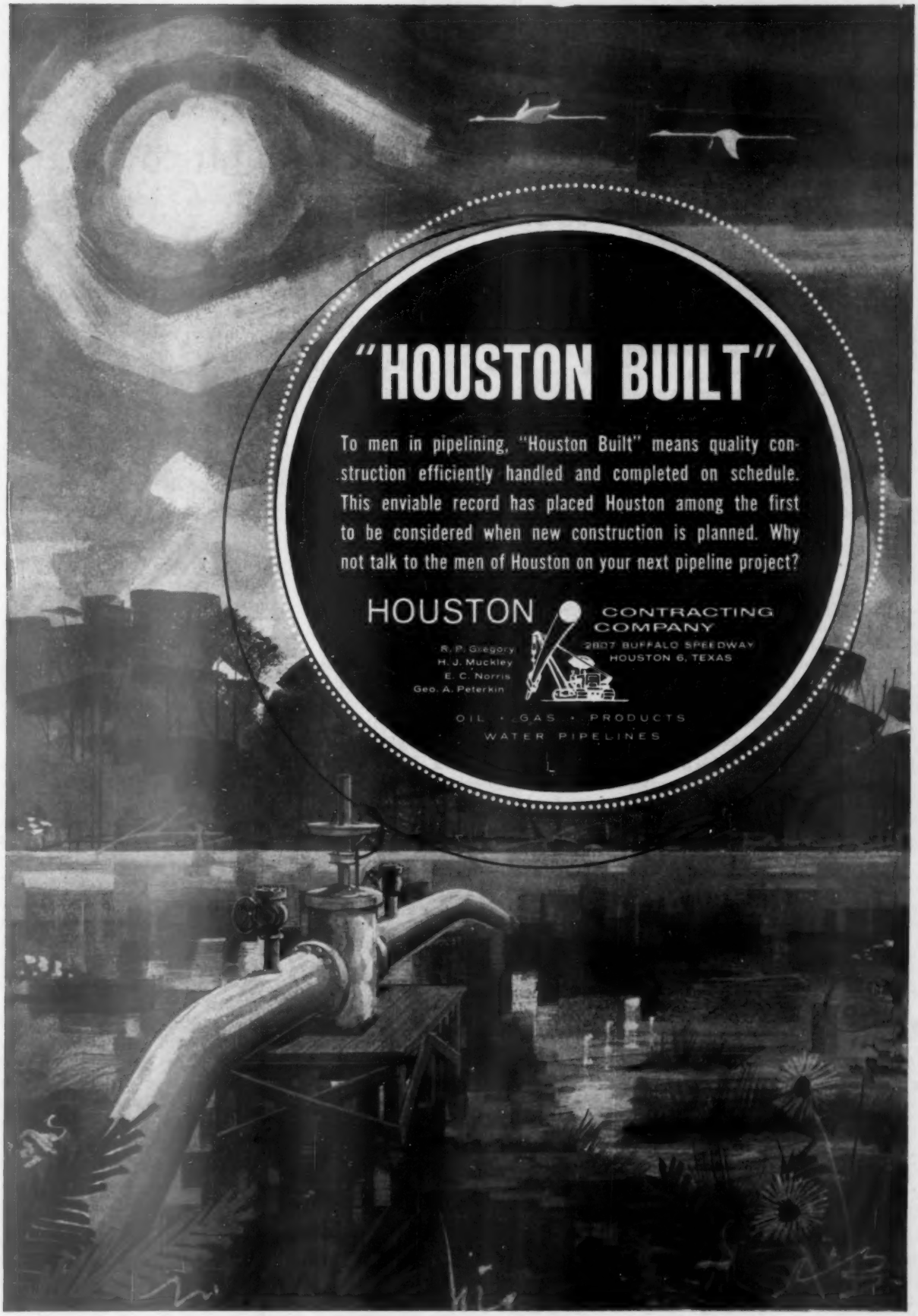
Republic Supply Co. makes three field assignments

J. C. Bergin, vice president for operations of Republic Supply Co., has announced the appointment of C. L. Gilmore to store manager at Nocona, Tex. Gilmore started with Republic Supply in 1954 in Wichita Falls, Tex. before moving to Nocona as assistant store manager. In 1957 he became field sales representative there.

Also announced were the appointments of Jerry Starr and Jerry Lacey as field sales representatives. Starr, who will represent Republic Supply at Alice, Tex., has past supply experience with HOMCO, Guiberson Corp., and Wilson Supply. Lacey, who will represent the company at Kimball, Neb., moves up from his head floorman position at the Kimball store. He was formerly with Mountain Iron & Supply in Kimball.

Hagan Chemicals names Holben to new post in Fort Worth

James H. Holben has been named Southwest manager of the Oilfield Division of Hagan Chemicals & Controls, Inc., Pittsburgh. Prior to his appointment, Holben was assistant director of Bradford Laboratories, oil-field-waterflooding consultants and a division of Hagan. Holben will be in charge of sales of oil-field chemicals, chemical-feeding equipment, and water-conditioning services.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To men in pipelining, "Houston Built" means quality construction efficiently handled and completed on schedule. This enviable record has placed Houston among the first to be considered when new construction is planned. Why not talk to the men of Houston on your next pipeline project?
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five good answers for paraffin problems

Dowell offers five products to help you combat paraffin problems in wells, flow lines and storage tanks. These products can help you hold down production costs and avoid unnecessary workovers. They also help increase income by increasing production and reducing downtime.

DEPBAN* paraffin inhibitor, used to *prevent* paraffin from adhering or depositing on metal well surfaces.

RED SOLVENT (P4). Dowell's general purpose, non-chlorinated paraffin solvent. The high efficiency of P4 has been proved by years of oil field use.

AMBER SOLVENT (P9). Special non-chlorinated solvent designed to remove asphalts and BS.

BLUE SOLVENT (P11). Chloride-free solvent designed especially for high-asphalt paraffins.

FREFLO*, Dowell mixture of oil-soluble, surface-active chemical agents, used to remove some asphalt and paraffin deposits in wells. Also used to prevent or break water blocks in wells.

Call your nearest Dowell representative for full information. *DOWELL TRADEMARK

PRODUCTS FOR THE OIL & GAS INDUSTRY

DOWELL

DIVISION OF THE DOW CHEMICAL COMPANY

Drilling breakthrough chops costs in East Texas

Close operator-contractor cooperation and preplanning cuts drilling time in half and slashes costs one quarter.

COAST-TO-COAST, company-to-company, and area-to-area, the current emphasis is on slashing costs. Proposed solutions to achieve this aim are a dime-a-dozen.

Some would have us believe that it will take new equipment, not yet developed, before we can make lower costs a reality. One operator felt it couldn't wait, so here's what it did to solve the cost problem:

A year ago operators in East Texas were puzzled with the problem of cutting drilling costs on the deep 14,000-ft. Smackover wells. A completed well ran between $400,000 and $500,000. Deep drilling wasn't commonplace in the area and there weren't many available rigs capable of reaching this depth. Nor were there many experienced crews working in the area familiar with Smackover-depth problems.

One operator, Pan American Petroleum Corp., was convinced that the wells could be drilled cheaper. Its plan was to work closely with the contractor, in this case, Parker Drilling Co., of Tulsa, and engineer the method of attack on the Smackover. Jointly, the contractor and the operator selected the rig size and type and personnel required, deciding finally to experiment with drilling techniques until the best combination was found. Even the hydraulics program was discussed at length. The ace in the hole was the operator's background of technical know-how and research facilities which could be called upon to overcome any troublesome factors.

The plan paid off. Drilling time was cut in half, from 120 to 60 days per well during the first year. Footage prices dropped $3 per foot, and over-all well costs plummeted 25%. The end isn't in sight yet, and further reduction is anticipated. Despite all this cost cutting, the contractor continued to keep a satisfactory margin of profit.

One thing the program points up is that savings can be made with present equipment and personnel, if there is a strong emphasis on close cooperation between operator and contractor. Planning and programing each well was a joint venture.

In this multiwell program, the first contract was on a straight daywork basis while the operator conducted experimental drilling techniques involving hydraulics, bits, casing programs, and the like. Detailed studies of the results of these tests afforded an equitable basis for changing the contract agreement to a footage rate to total depth. This was possible because the contractor knew the problems he faced and could use his equipment and personnel efficiently because of experience gained on the first test.

One of the best factors of the operation was its continuity. The same contractor, crews, and equipment were used on successive wells and the experience gained on each hole was applied to the next. This had decided advantages over bringing in new personnel and equipment for each well.

Both the highlights and the details of this drilling campaign were discussed fully before the Houston AAODC meeting last month by

Performance of chert-type bits in East Texas

	Well A*	Well B	Well C	Well D	Well E
Number of bits	10	9	11	14	16
Reruns	4	1	1	0	0
Footage	1,195	1,303	2,277	3,956	4,443
Hours	289¾	198	399½	618¼	657¼
Feet per hour	4.12	6.58	5.7	6.4	6.8
Feet per bit	119.5	145	207	283	278
Hours per bit	29.0	22	36.3	44.2	41.1

*Well A was the discovery well and was drilled with gel-chemicals gyp-base mud. Wells B through E were drilled with low-solids-polymer mud.

J. E. Fox, Jr., Pan American Petroleum Corp. Because the geology of this sector of East Texas is quite complex, drilling is subject to unexpected difficulties. Despite this, improvements are continuing and the most recent well completed shows cost reductions greater than those reported so far. Another test is already under way and further techniques will be tried.

Prime significance of this program is that it shows that present-day applications of equipment and personnel, without any razzle-dazzle innovations, can effect cost cutting.

In short, the success of this program is based directly upon the following factors:

First, the close cooperation between operator and contractor gave the dual benefit of avoiding many problems through preplanning, and resolving more effectively those which did arise.

Second, the contractor's selection of efficient rig personnel is an important consideration in any drilling program.

Third, the quality of the drilling equipment is matched with the depth and specific requirements of East Texas. In this case the rig was a basic National 125 with three pumps, special blowout preventers and controls, and rigged up on a 136-ft. Lee C. Moore jackknife derrick. This is currently the largest rig working in East Texas and is designed to handle hydraulic programs encountered in the work.

Fourth, a most valuable contribution to the success of the work was the recommendations and assistance of Pan American's Research Center working jointly with the area and district personnel. Through their efforts, the contractor used an advanced-type hard-formation bit at nearly all depth levels due to the extremely low-solids mud used in the system. Initially, hydraulic programs of high pressures were used. But it was learned that this was not essential to fast penetration. The big factor was the design and control of the mud system to maintain a solids level of five or less.

More detailed studies of some of the amazing results of this program are available from Hughes Tool Co., Pan American, and the mud companies who participated in the drilling program. The results prove that important cost reductions can be accomplished through cooperative joint efforts of the operator, contractor, and service companies.

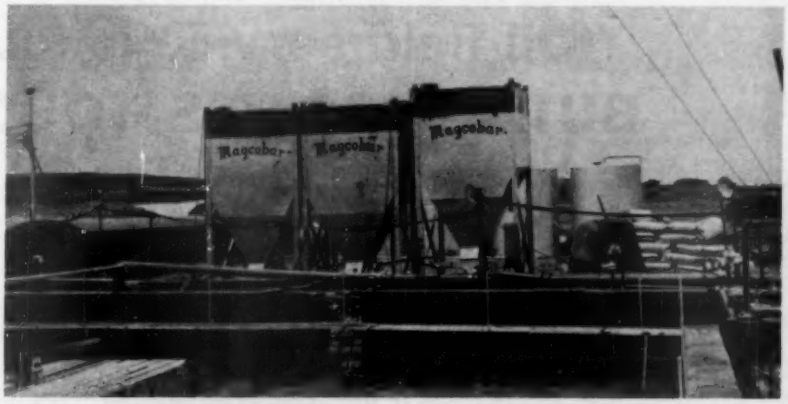
New Alaska wells slated

RECENT WORD from Alaska shows three new exploratory tests are set for drilling soon. The Division of Mines and Minerals announced that its petroleum branch has granted drilling permits for these operations which are all west of the Cook Inlet.

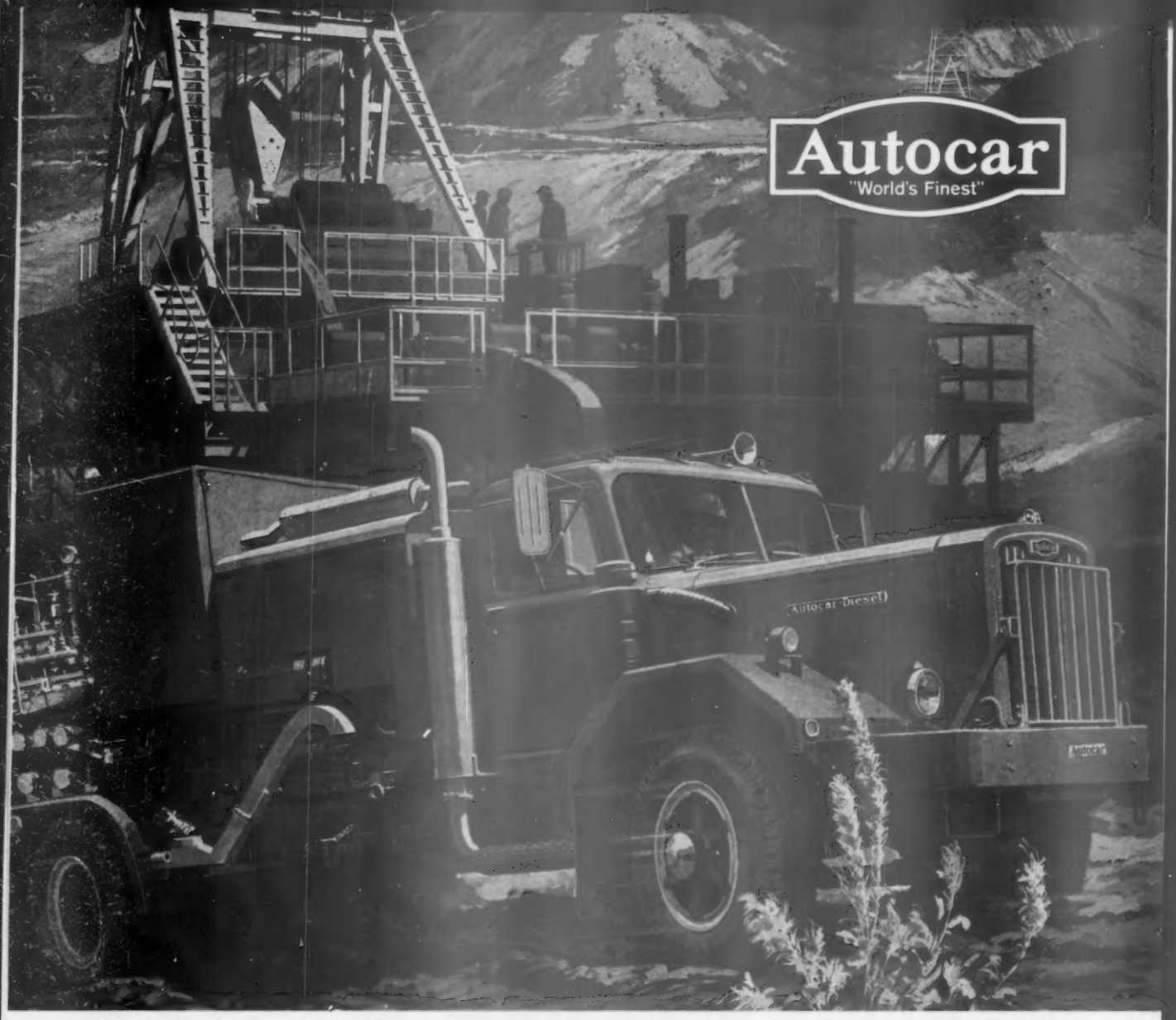
Pan American Petroleum Corp. 1 West Foreland, NE SE 21-8n-14w, Seward B. & M.; Pan American 1 Stedatna Creek-State, C SE SW 30-12n-12w, Seward B. & M.; and Superior Oil Co. 1 Chuit-State, 2,500 ft. north and 850 ft. east from the southwest corner of Section 8-12n-11w, Seward B. & M. are the ventures scheduled. The latter two are initial tests on the recently leased Tyonek Bombing Range.

Current activity in the state presently includes: Richfield Oil Corp. 1 White River unit, 7,982 ft., testing; Richfield 1 Bering River unit, drilling at 5,888 ft.; Colorado Oil & Gas Corp. 4 Core Hole, drilling at 3,000 ft.; Belco 1 Antonio Zappa, testing; Standard Oil Co. of California 1 Chaix Hills unit, drilling at 8,405 ft.; SOCAL 34-9 SCU, drilling at 10,466 ft:; SOCAL 21-4 SCU, 10,896 ft. TD, preparing to complete; SOCAL 41-28 SRU drilling at 6,371 ft.; and SOCAL 43-15 SRU (RD), 11,380 ft. TD, preparing to complete.

The following wells were completed; Union Oil Co. of California 12-8 Fish Creek unit, 6,418 ft. TD, plugged and abandoned; Pan American Petroleum Corp. 1 Napatuk Creek, 14,910 ft. TD, plugged and abandoned; Pure Oil Co. 1 Canoe Bay unit, 6,642 ft., plugged and abandoned; Hackathorn 4 Rosetta, 1,627 ft. TD, plugged and abandoned; SOCAL 212-27 Swanson River unit, 7,800 TD, shut-in gas well; and SOCAL 34-5 Soldotna Creek unit 11,220 ft. TD, oil producer.



WILL BULK MUD catch on in the Mid-Continent area? Here's an example of one of the first applications used in western Oklahoma. Bulk mud with bins like these is in common use of the Gulf Coast, but for the most part sacked mud is presently more popular in Mid-Continent operations. These hoppers will store 750 sacks each and provide fast, easy handling and cut down loss and labor in handling-fluid additives. Operation is Continental Oil et al. 1 Corn unit in Washita County, Oklahoma. Equipment on location is Parker Drilling Co. Rig 66.



Nothing less than Autocar satisfies oil-field service men. They know that however tough the going, Autocar walks through it.

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Let's make it the AAPG Bulletin again

BY FRANK J. GARDNER

ARE YOU READING more now and enjoying it less? Could be, if you're a member of the AAPG. And it may well be your own fault—not that of AAPG.

First off, let it be known that this is not intended as a criticism of the AAPG Bulletin. This reporter has learned the hard way that to criticize AAPG is to be put on a committee of correction. Rather, the criticism is aimed at the **members** of AAPG.

But the association's monthly bulletin has changed complexion over the years. For some members, it's all to the good. But others are critical. "It's easier to read and harder to understand," comments one member. "I don't see much oil hunting in it any more," says another. And from a fledgling member: "It needs a haircut."

In the current issue of the Houston Geological Society's Monthly Bulletin, George C. Hardin, Jr., president of the group, has this to say: "In recent years, there has been a decrease in the percentage of commercial geologists preparing technical papers for publication. A check of the AAPG Bulletin shows that most of the papers . . . in it are prepared by geologists associated with universities or governmental surveys."

This sent us on a search. Had the Bulletin really changed that much?

It had. A check of 12 issues for 1940 and 1941, 12 for 1950 and 1951, and 12 for 1960 and 1961 (excluding special numbers) produced the statistics pictured on this page. In 20 years, contributions by Hardin's "commercial" geologists have declined from 53% to less than 34%. The professors have held steady at about 30%, while government survey people have increased their contributions from 18 to 20%. The real comer (and this is significant) has been the research man, who has pushed his output from less than 1% in 1940-41 to a hefty 15% in 1960-61.

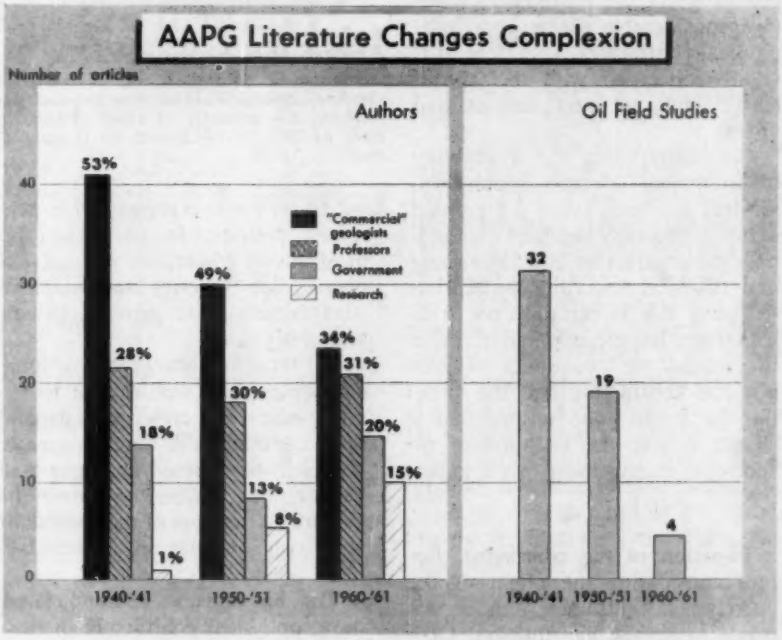


CHART POINTS UP the steady decline in contributions to the Bulletin of the American Association of Petroleum Geologists by the so-called "commercial" geologist members. Right-hand chart displays big drop in number of oil-field studies in same 20-year period.

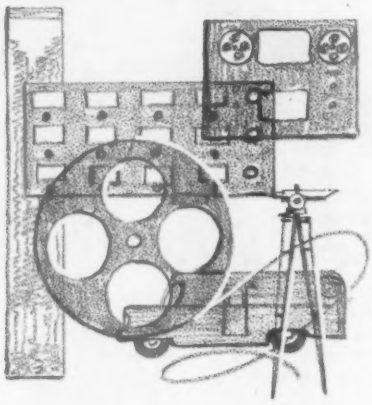
For those who contend that the Bulletin is not as "oily" as it used to be, here's news: it isn't. The number of oil-field studies printed has declined from 32 in 1940-41 to only 4 in 1960-61; during the first 10 months of 1961, only one such study has appeared, and—you guessed it—a research man wrote it. This decline may be attributable to the upsurge in recent years of statewide field volumes such as those covering Colorado, Nebraska, Wyoming, Kansas, New Mexico, Utah, and two feeble efforts in Texas. But these volumes must of necessity cover a field only vaguely; they cannot present a study in depth.

What's behind this change in complexion of the Bulletin? It's not the editorship, for in 1940-41, the editor was a professor; in 1960-61, he's a professor; in 1951, he was a government survey man. The emergence of the research geologist as a major contributor is very much in order and all to the good. Professors and survey men are steady sources of top information. But the disappearance of the field man from the pages of the Bulletin must be laid at his own door.

As George Hardin puts it, "This avoidance of the preparation of papers by commercial geologists is deplorable, and suggests lack of interest in the profession, particularly by younger geologists. The preparation of a technical paper is undoubtedly the most productive means of self-education available to the scientist. Those who have prepared papers for publication have found that no one learns as much from them as the author."

In geophysics

Fate of contractors is in industry's hands



BY FRANK GOLDSTONE
Consulting Geophysicist, Houston

About the author...

Frank Goldstone is a graduate of Cambridge University, England. He joined the Shell group in 1922 and entered the field of geophysics in 1924. For 25 years he held the capacity of chief geophysicist for Shell Oil Co. Goldstone was president of SEG in 1942 and he is now a consultant in Houston since retiring from Shell in 1959.

IN CARRYING out its exploration program, the oil industry relies to a considerable extent upon geophysical contractors. Therefore, it is vitally concerned with their problems which are now serious and urgent.

For many years the availability of competent contract geophysical services has been taken for granted and it is generally assumed that geophysical contracting is a flourishing and financial rewarding enterprise.

Today this is certainly not true. The writer has recently had occasion to analyze the economics of geophysical contracting and the situation he found is so serious that it should receive the attention of responsible management in the industry.

Function of the contractor. Before considering the plight of the geophysical contractor, it is appropriate to review his function. Of a total of some 400 domestic seismograph crews now in the field over one-half are owned by contractors. Furthermore, in the development of geophysical instruments and techniques, research by contractors has made major contributions at least equaling those of the oil companies.

Most smaller operators and some of the major companies do not attempt to maintain their own geophysical staffs; rather, they rely on contractors and consultants to conduct their geophysical work. These concerns require a complete contracting service including field work, analysis of field data, and access to the results of research.

Most major companies follow a compromise course, maintaining a staff of geophysicists for research, supervision, and review, but splitting their field work between their own and contract crews. Of recent years, many major companies have found that the nature of geophysical field work involving erratic operating schedules and frequent moves does not fit well into company-wide personnel policies. In particular the problems of overtime, moving expenses, job security and employe advancement have proved difficult and costly.

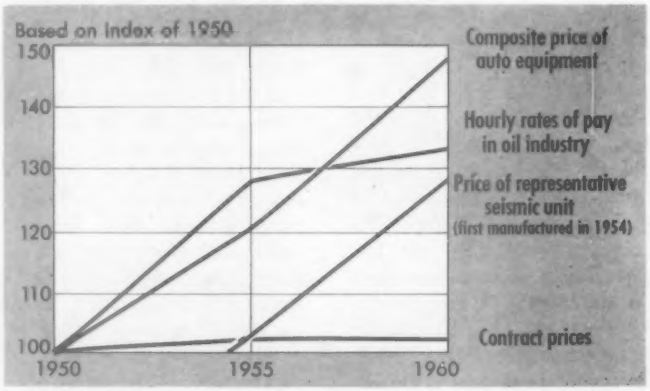
For these and other reasons, some companies may well decide to reduce their own crews and depend upon contractors to an even greater degree in the future. This may well happen, but it does not solve the immediate problem of the contractor who wishes to stay in business.

The big squeeze. Baldly stated, the geophysical contractors in their domestic operations have been caught in a squeeze between rising costs and a falling demand for their services. In general, the client companies have taken advantage of the excess of available crews to resist any increase in contract prices and have in some instances forced a reduction in prices under those prevailing in recent years. The contractors themselves have preserved their tradition of competitive bidding, with the result that many contracts are now operated at a loss.

This statement will not be readily accepted without demonstrating its truth. As to the level of field operations, the statistics are available; from a high of nearly 700 domestic seismograph crews in 1952, the number fell to 500 in 1957 and is now down to about 400.

As to costs, two significant comparisons are presented below: in the first place, the increase in contract prices for identical services through the past 10 years is compared with the increases in various constituent costs; in the second place, the average cost of operating a field crew is computed and compared with going contract prices.

Since seismograph work represents the major part of geophysical operations, this discussion is restricted to such work. For comparison purposes it is necessary to adopt a standard basic crew; this has been taken to consist of an office staff

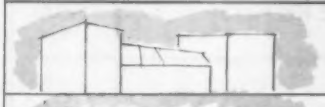
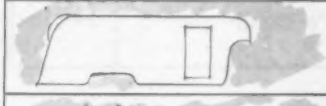


HERE'S HOW contract prices compare with contractors' costs. Fig. 1.

of three, a field complement of seven, four vehicles, a recording unit and supplies, and surveying and shooting equipment. The quoted figures are for direct recording on paper; for magnetic tape recording and playback a higher price is obtained.

Cost vs. price. The present average contract price for this standard basic crew is $8,500; 10 years ago it was $8,250. Fig. 1 compares this increase with the increase in cost of major items which enter into operating expenses. It is apparent that whereas costs have risen from 30 to 50%, contract prices have risen only 3%. These figures were derived from the records of a large number of contractors who made them available for this purpose.

COST OF SEISMIC EQUIPMENT

Item of equipment and life	Capital outlay	Depreciation per month
 Instruments 4 yrs.	$25,000	$521
 Recording cab 4 yrs.	4,100	85
Recording truck 4 yrs.	2,750	58
Shooting truck 4 yrs.	2,750	58
Shooting body and accessories 4 yrs.	3,800	80
Survey truck 2 yrs.	2,300	96
Survey equipment 4 yrs.	1,500	31
Party chief's car 3 yrs.	2,200	61
One-crew Total	$54,000	$990

Loading factor (employe benefits, insurance, FICA, etc), computed as a percentage of the payroll equals 16.75% of $4,515, or $756.*
Six per cent interest on the loan amounts to $272.
Depreciation and interest add up to $1,262.

Operating expenses

Field office—rent and utilities, maps and supplies, furniture and office equipment, freight, etc.	$450
Recording unit—truck operating cost, seismometers and cables, instrument maintenance, supplies, paper, chemicals, etc.	625
Survey unit—truck operating cost, supplies, etc.	220
Shooting unit—truck operating cost, supplies, etc.	225
Sundry—party chief's car-operating cost, equipment insurance, travel expenses not reimbursed, etc.	250
Total	$1,770

With capital outlay and depreciation for equipment, this makes a total field operating cost of $8,303.

*This compares with a 1960 U. S. Chamber of Commerce average figure of 22.8% for 1,064 companies studied and with major oil-company figures which run as high as 29%.

These are the direct costs to which must be added overhead which is less easily standardized. One inescapable item is supervision, which usually involves the services of one experienced geophysicist for each two or at most three field crews; this imposes a further cost of from $600 to $900 per crew-month.

From the nature of his business a contractor must maintain a sales effort both in advertising and in client contacts which will vary widely but is always substantial. The cost of maintaining a head office must be provided for; again this will vary widely between contractors.

A reasonable figure to take for supervision and head office overhead is 20% of field operating costs. Research and employe training were at one time a major concern of geophysical contractors, some spending as much as 10% of their budget on such activities; nowadays these are vanishingly small. Idle time on personnel and equipment must be figured, and experience has shown that contract prices should carry a 10% burden to cover this item, although in certain geographical areas, such as Canada, and at low points in the exploration cycle, the figure may be much higher.

Finally, many companies expect their contractors to furnish supplies not provided for in the contract (such as explosives) at cost, without any handling charge and may even insist on being given the benefit of cash discounts, even though the contractor must carry such accounts on behalf of his client for periods sometimes up to 3 months.

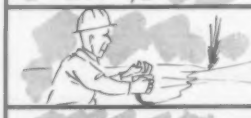
It appears that a contractor who plans to stay in business is faced with the following minimum costs to keep a crew in the field:

Field operating costs for a standard basic crew	$8,303
Supervision and head-office expense estimated at 20%	1,661
Idle time estimated at 10%	830
Total	$10,794

If any major company geophysicist doubts the validity of these estimates, it is suggested that he compare them with equivalent costs for company crews; he will probably find the company crews to be about 20% higher.

How some contractors hang on. Since the average contract price for

THE 50-HOUR-WEEK PAYROLL

PARTY CHIEF	$700	SURVEYOR	525
ASST. PARTY CHIEF	500	JR. SURVEYOR	400
COMPUTER	460	 SHOOTER	340
OBSERVER	550	2 HELPERS	600
JR. OBSERVER	440	Per-month total	$4,515

this crew is $8,500, it is evident that either the operating costs quoted above are not representative or geophysical contractors are rapidly going broke. In actual fact there is some truth in both assertions. The quoted costs and contract prices refer to domestic operations contracted on a monthly basis. However, during the past decade many contractors have expanded their foreign work which, until recently, showed more adequate profit margins.

Even in the foreign field, with all the increased political hazards, competition has in the last couple of years forced contract prices down. In domestic work it is frequently possible to get short-term jobs on a daily or per shot-point basis which, if crews can be kept busy, return a higher profit.

A further source of profit is in shot-hole drilling. When a seismograph contractor is allowed to conduct the shot-hole drilling on his crew at going contract prices, he is also to recoup some of the loss on other phases of the work.

As a last resort, it is indeed true that under existing pressures, a contractor will continue equipment in service beyond its normal life and will defer replacement of obsolete equipment; he will also attempt to shade salaries. These practices may tide over a brief period of unprofitable operation but they do not offer a long-range solution to the problem and are certainly not in the best interests of the industry.

Why costs are rising. It is fully realized that the total cost of a seismograph survey, particularly if computed on a per mile basis, has risen sharply during the past few years, and that management is critical of this increase. It is instructive to examine the contributing factors which are as follows:

1. Techniques and field procedures have radically changed since 1950. Areas of easy shooting are in the main fully explored and a typical field program now involves shooting across unfavorable terrain with the use of multiple shot holes (normally from two to nine, but occasionally up to 100 holes per shot point) and multiple seismometers involving complex cable arrays.

Such techniques will produce critical data not otherwise available but always at a greatly increased cost per mile. It is a reasonable guess that the average cost per mile of continuous profile has doubled in the last 10 years due to this cause alone.

It will increase further unless checked by a discriminating use of such methods, which requires that the planning and conduct of field work be in the hands of highly trained and experienced men. It is, of course, to be hoped that research in field methods will develop new and cheaper ways of obtaining data in difficult areas and the cost of this research should be considered a normal part of current operating expenses, whether carried out by contractors or by oil companies.

2. The use of magnetic tape recording and the subsequent playback procedures, including the preparation of composited record sections, has imposed an added expense of from $1,000 to $2,000 per crew per month.

3. The cost of high-velocity explosives has increased 25% in the last 10 years and the use of multiple shots has increased the dynamite consumption per mile of profile. This increased cost has been offset to some degree by the ingenuity of the geophysicist in developing the use of other and cheaper explosives.

4. Permit costs which were negligible (except for West Texas) have assumed major proportions and now frequently represent 25% of field-operating costs.

5. The seismograph contractor gets about $250 a month more for his basic crew than he did 10 years ago and so makes a modest contribution to the very large over-all increase in costs.

By far the greatest of the above factors is the first, which results from our pressing need for better data if we are to solve the increasingly difficult problems now facing the exploration team. In the writer's opinion, the best immediate remedy for mounting field costs is to insure

that these expensive operations are in the hands of competent experienced geophysicists capable of getting the desired answers with a minimum of field data.

The seismograph contracting business is in a rather unusual position in that it sells services which are a combination of routine field operations and highly skilled professional consultation. The former can be specified and contracted for on the basis of quantity, but it is virtually impossible to specify the quality of the resulting subsurface map. This difficulty has led some clients to emphasize quantity of output and low cost per mile almost to the exclusion of quality, whereas experience has surely demonstrated that inferior data poorly interpreted can be very costly even at the lowest price.

What the industry must do. Acceptable results in today's difficult exploration areas can be expected only from well-trained experienced geophysicists using the best available instruments and technique.

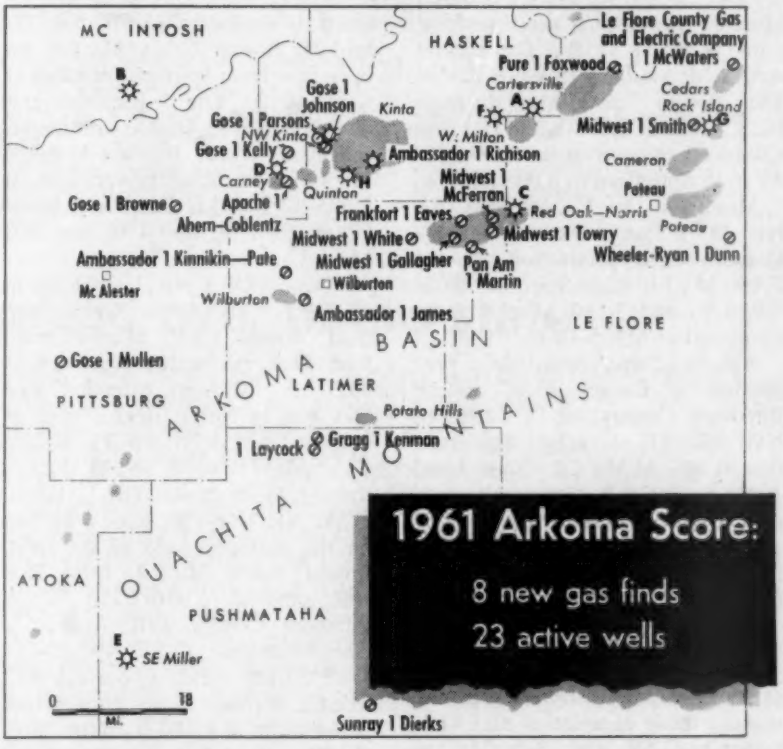
If the oil industry wishes and expects contracting geophysical companies to furnish such services in the future, it must make it possible for them to retain their present experienced staffs and to meet the expense of hiring and training promising young technical men and of offering them, when trained, a career as secure and rewarding as in other branches of industry. It must be willing to underwrite the cost of research on instrumentation and field techniques which is necessary to keep contractors up to date and proficient in their field.

The present tendency to seek the lowest possible contract prices will not accomplish these longer-range objectives. It is unfortunately true that many experienced and therefore irreplaceable men are abandoning geophysics as a career and very few indeed are entering the ranks, at least with contracting concerns. It is impossible to overemphasize the seriousness of this trend.

Seismic interpretation is far more than a routine which can be quickly learned. It involves the exercise of imagination and judgment of a high order which is most difficult to cultivate, and the loss to the industry of a competent interpreter must be looked upon as a serious matter.

Old hands in the industry—and many of them are to be found in the ranks of the contractors—know this and will do everything in their power to keep such men where they belong, in petroleum exploration. However, it is expecting too much to look for contractors to keep operating indefinitely at a loss purely out of loyalty to their employes and to the industry. In a surprising number of instances these are the only motives which keep long-established contractors in business.

The oil industry must decide whether it will continue to need competent contracted geophysical services, and if it does must be prepared to raise contract prices and abandon its present attitude of shopping for bargains. Except for downgrading the quality of their work, which most will not do, the contractors themselves have no recourse except to go out of business, which many have done and more will do in the near future unless they are more adequately paid for their services.



THE TWO-STATE ARKOMA BASIN is fast becoming a gas producer. Although the Oklahoma side hasn't yet caught up with the Arkansas side in the number of fields, Sooner Arkomans are busy opening up deep gas reserves.

Sooner part of Arkoma sets fast drilling pace

EIGHT DISCOVERIES and 23 active tests make Oklahoma's portion of the Arkoma basin one of the busiest areas in the Mid-Continent region this year.

This two-state basin has been in gas-world prominence since 1960 when deep Spiro and Atoka gas production was tapped in Wilburton, Red Oak-Norris, Carney, Kinta, and Quinton fields.

Kinta first. This Haskell County field was the first probed for deeper production. Superior Oil Co. had opened Lona field north of shallow Kinta field production. Ambassador Oil Corp. had drilled on the south side of the area. Ambassador et al. 1 Davenport, NE SW NE 33-8n-20e, Haskell County, flowed 2,459 M.c.f.d. from basal Atoka Pennsylvanian at 5,542-70 ft. This was

followed by another Atoka well in 5-7n-20e. Apache Oil Corp. opened Northwest Kinta field in 14-8n-19e several months later.

Midwest Oil Corp. discovered deep production in Norris field on the Latimer-LeFlore County line at 1 Orr, C SW 8-6n-22e. This dual Red Oak and Spiro flowed 18 M.M. c.f.d. from Spiro perforations at 11,514-80 ft., and 17 M.M.c.f.d. from Red Oak at 7,193-7,330 ft. Development of this deep production has been fast since last year. Ambassador Oil Corp. 1 Williams, southeast of Wilburton gas field in C NW 23-5n-18e, flowed 8,300 M.c.f.d. from Spiro sand perforations at 8,811-31 ft. The second well, 1 McAlester, C SW NE 22-5n-18e, flowed 7,592 M.c.f.d. from basal Atoka at 8,288-8,328 ft. From Cromwell Pennsylvanian at 9,216-42 ft. in flowed up to 8,068 M.c.f.d.

Mobil Oil Co. 1 Quinton, C SE NE 11-7n-19e, next to shallow Quinton field production, flowed 7,450 M.c.f.d. from Spiro at 5,862-5,920 ft. and 3,680 M.c.f.d. from Cromwell at 6,305-33 ft.

Apache Corp. opened deep production in Carney field, eastern Pittsburg County, at 1 Etchison, NW SE NE 4-7n-1e. This well flowed 10 M.M.c.f.d. from basal Atoka at 6,225 ft. Cartersville field in LeFlore County is also undergoing deep exploration. Other 1961 discoveries and 1960 finds are noted on the accompanying tables.

Current development. Important wells are drilling in various areas of Arkoma. Midwest Oil Corp. will make a triple completion at 1 Gallagher in C SE NW 13-6n-21e, on the west side of Norris Deep field, Latimer County.

The well flowed 3,648 M.c.f.d. from perforations in upper Red Oak sand at 6,758-6,833 ft.; on second point, volume was 5,328 M.c.f.d.; on third point it was 6,480 M.c.f.d. From lower Red Oak at 7,975-8,037 ft., the well flowed 2 M.M.c.f.d.; from Spiro at 11,918-33 ft. flow was 5,750 M.c.f.d. Northeast of this discovery, Frankfort Oil Co. 1 Eaves, C SW SE 6-6n-22e, topped Spiro sand at 11,672 ft. and was coring from 11,680 ft.

Ambassador Oil Corp. will try for a linkup between South Lewisville and Kinta fields. The 1 Aldridge unit, southwestern Haskell County, C NW SE 6-7n-20e, will go to 6,250 ft. and Cromwell. Robison-Marshall Drilling Co. has contract for this test.

Midwest 1 Dye, SW NE SW 1-6n-22n, on the east side of Norris Deep field, will go to 7,200 ft. and Red Oak.

Steve Gose 1 Johnson, SW NW SE 21-8n-19e, in Northwest Kinta field, Haskell County, looks like one of the best Atoka basal sand wells yet. Volume was 20,500 M.c.f.d. while drilling at 6,128 ft. in the basal Atoka. Volume then increased to 35-40 M.M.c.f.d. at 6,148 ft.

In Northwest Kinta field, Ambassador 1 Wimberly, C SW NE 27-8n-19e, flowed 6,094 M.c.f.d. on open flow from Spiro perforations at 6,007-40 ft. The 1 Richison unit in C NW SE 32-8n-20e, southwestern Kinta field, flowed 4,720 M.c.f.d. from Spiro perforations at 5,625-37 ft. Gas flow from lower Cromwell at 6,106-64 ft. was 250 M.c.f.d.

Midwest Oil Corp. 1 Coblentz in SE SW NE 16-6n-22e, Norris Deep field, flowed 2,130 M.c.f.d. from Red Oak perforations at 6,932-7,036 ft. Midwest extended Red Oak pay in Norris field 1 mile at 1 Towry in N½ NE SW 11-6n-22e. This one flowed 18 M.M.c.f.d. through ¾-in. choke. The 1 Martin, C SW NE 3-6n-22e, same area, but on the northeast side of the field, flowed 9,400 M.c.f.d. from Red Oak sand at 6,956-7,220 ft. A Pittsburg County well, Apache 1 Ahern-Coblentz, C SE NW 10-7n-18e, Carney field, flowed 972 M.c.f.d. through ¾-in. choke from perforations at 4,496 ft. in the Dirty Creek section of Atoka.

Active wells in Oklahoma's Arkoma basin

1. Haskell County: Steve Gose 1 Parsons unit, SE SW NE 17-8n-19e. Testing. Basal Atoka 6,168 ft., Wapanucka 6,244 ft., Cromwell 6 589 ft. TD 6,800 ft.

2. Haskell County: Steve Gose 1 Johnson unit, SW NW SE 21-8n-19e. Has run 5½-in. casing. Gas at 6,128 ft.

3. Haskell County: Ambassador Oil Corp. 1 Richison, C NW SE 32-8n-20e. IPF 5,663 M.c.f.d., Spiro sand. Gas in other zones also.

4. Haskell County: LeFlore County Gas & Electric Co. 1 Farafield, SW SW NE 19-8n-22e. Location.

5. Latimer County: Ambassador 1 Kinnikin-Pate unit, SW NW SW 3-5n-18e. Wildcat. Drilling below 11,785 ft.

6. Latimer County: Ambassador 1-A James unit, NE SW NW 24-5n-18e. Drilling below 2,555 ft.

7. Latimer County: Midwest Oil Corp. 1 Gallagher, C SE NW 13-6n-21e. Will complete in three zones at this Norris Deep field well.

8. Latimer County: Midwest 1 White, SW NE SE 18-6n-21e. Wildcat drilling below 6,734 ft.

9. Latimer County: Midwest 1 McFerran, NW NE SW 2-6n-22e. Drilling below 1,640 ft.

10. Latimer County: Frankfort Oil Co. 1 Eaves unit, SW SE 6-6n-22e. To core from 11,680 ft.

11. Latimer County: Midwest 1 Towry unit, N½ NE SW 11-6n-22e. Testing. Flowed 4,500 M.c.f.d. Red Oak 7,080-87 ft.

12. Latimer County: Pan American Petroleum Corp. 1 Martin unit, NE SE NW 20-6n-22e. TD 7,900 ft. Red Oak 7,442 ft. WOC.

13. LeFlore County: Wheeler & Ryan 1 Dunn, SW SW 16-6n-27e. Wildcat drilling below 10,890 ft.

14. LeFlore County: Midwest 1 Smith unit, NW NW SE 11-6n-26e. Testing gas in Spiro sand.

15. LeFlore County: Pure Oil Co. 1 Foxwood, NE SW 6-9n-25e. Wildcat. Perforating.

16. LeFlore County: LeFlore County 1 McWaters, SE NE SW 4-9n-27e. Location.

17. Pittsburg County: Carter-Gragg Oil Co. 1 Mullen, C SE SW 29-4n-14e. Wildcat drilling below 11,441 ft.

18. Pittsburg County: Steve Gose 1 Browne, E½ NW NW SE 28-7n-16e. Wildcat shut down for orders. TD 8,620 ft. in Hunton Siluro-Devonian.

19. Pittsburg County: Apache Corp. 1 Ahern-Coblentz, C SE NW 10-7n-18e. Testing.

20. Pittsburg County: Steve Gose 1 Kelly, NE SE NW 27-8n-18e. Wildcat shut down for orders.

21. Pushmataha County: Gragg Drilling Co. 1 Kenman, NE NE 8-2n-19e. Wildcat drilling below 3,250 ft.

22. Pushmataha County: Gragg 1 Laycock, SE NE 17-2n-19e. Drilling below 550 ft.

23. Pushmataha County: Sunray Mid-Continent Oil Co. 1 Dierks, C NE SW 16-4s-20e. Drilling below 570 ft. Remote wildcat location deep in Ouachita Mountains.

Oklahoma Arkoma discoveries this year

1. Haskell County: LeFlore County Gas Co. 1 N. C. Holt, SW SW NE 33-9n-23e, 3½ miles northeast of West Milton gas fie'd. IPCOF 628 M.c.f.d., basal Atoka Pennsylvanian sand 5,451½-54 ft. TD 5,903 ft. Opens Southwest Cartersville field. A on map.

2. McIntosh County: Southern Union Gathering Co. 1 Turley, NE NW NE 21-9n-15e. IPF 10,824 M.c.f.d., Cromwell Morrow Pennsylvanian 4,274-92 ft. TD 4,961 ft. Gas discovery in Mellette area. B on map.

3. LeFlore County: Midwest Oil Corp. 1 Goldsborough, SE SW NE 31-7n-23e, 16 miles west of Poteau. IPF 2,710 M.c.f.d., open 2½-in. tubing, Red Oak 6,986-7,084 ft. FTP 1,825 psi., SITP 2,986 psi. TD 13,384 ft. New gas discovery in Norris Deep area. C on map.

4. Pittsburg County: Apache Oil Corp. 1 Etchison unit, NW SE NW 4-7n-18e. IPCOF 4,707 M.c.f.d., basal Atoka Pennsylvanian sand 6,184-6,212 ft. TD 6,902 ft. Geological wildcat discovery in Carney field. D on map.

5. Pushmataha County: J. T. Stephenson & King Stevenson Oil Co. Inc. 1 Brame, C NW SE 15-3s-15e. 3 miles southeast of Miller townsite. IPF 500 M.c.f.d., open tubing and 1 BOPD through 2⅞-in. tubing, Stanley Mississippian 3,062-5,150 and 5,240-5,640 ft. TD 8,371 ft. E on map. Opens

Significant gas fields in Oklahoma's Arkoma basin*

Field, County, and year of discovery	No. of wells	Structure, Pay zone,	M.c.f. Cum. Prod. 1/1/61
1. Wilburton, Latimer, Atoka 1925, Spiro 1960	5	Heavener, Atoka 2,700, Spiro 8,821	49,388
2. Red Oak-Norris, Latimer, Hartshorne 1912, Atoka, Spiro 1960	42	Brazil, Hartshorne 1,500-2,100 Red Oak (Atoka(1,250, Spiro 11,540	46,929,478
3. Quinton area†, Pittsburg, Haskell 1915	120	Quinton, Hartshorne 7,50-2,700	154,714,917
4. Kinta, Haskell, shallow 1931, deep 1937	29	Kinta, Hartshorne 750-1,350, Spiro 5,608	970,807
5. East Lona, Haskell, 1952	7	Kinta, Spiro 5,583, Cromwell 5,970	6,616,182
6. West Milton, LeFlore, 1958	1	Milton, Spiro 5,580	57,357
7. Poteau-Gilmore, LeFlore, 1910	40	Gilmore, Hartshorne 1,300-1,900	35,607,249
8. Cameron, LeFlore, 1911	6	Midland, Hartshorne 1,325	4,637,037
9. Rock Island, LeFlore, Hartshorne 1922, Atoka 1961	3	Backbone, Hartshorne 1,365-1,990, Atoka 5,235	541,998
10. Cedars, LeFlore, 1924	8	Massard, Prairie, Atoka 2,220, Spiro 6,170	7,252,418
11. Cartersville, LeFlore, 1930	19	Milton, Atoka 1,480, Spiro 5,020-5,400	94,660,374
12. Redland, Sequoyah, 1923	6	Milton, Atoka 1,650, Spiro 6,050, Cromwell 6,250	2,582,107
13. Brent, Sequoyah, 1957	1	Gans, Cromwell 3,015	none
14. Southwest Gans, Sequoyah, 1942	2	Gans, Atoka 1,510	1,398,226
15. Gans, Sequoyah, 1927	3	Gans, B. Atoka 2,900, Cromwell 3,170	416,805
16. Northeast Gans, Sequoyah, 1925	1 abd.	Gans, Atoka 3,045	no record
17. Roland, Sequoyah, 1926	3	Gans, Atoka 2,270	121,578
18. Greenwood Junction, Sequoyah, 1928	4	Gans, Atoka 805-1,205	340,341

*From TGS-FSGS, Arkoma field trip Guide book 1961. †Featherston, Quinton, and Carney.

Southeast Miller field.

6. Haskell County: LeFlore County Gas & Electric Co. 1 O. Gross, SE SE NW 2-8n-22e, 3½ miles northwest of West Milton field. IPF 250 M.c.f.d., through 8⅝-in. casing from Atoka; IPF 3,232 M.c.f.d., through 2⅞-in. casing from Spiro sand; 10,950 M.c.f.d.; through 2⅞-in. casing from Cromwell sand. Triple-zone completion. F on map. TD 6,290 ft.

7. LeFlore County: Midwest Oil Corp. 1 Floyd Morris, SW NE 12-8n-26e, 1½ miles west of Rock Island. IPCOF 2 M.M.c.f.d., Atoka sand 5,205-62 ft. TD 9,216 ft. Revives abandoned Rock Island gas field. G on map.

8. Haskell County: Mobil Oil Co. 1 Quinton unit, C SE NE 11-7n-19e. IPF 11,130 M.c.f.d., Spiro sand 5,862-5,920 ft.; Cromwell 6,305-30 ft. TD 6,579 ft. Gas discovery. H on map. Opens South Lewisville field.

Sooner drilling spread over entire state

EXPLORATORY SUCCESS continues to climb briskly in Oklahoma. All sectors of the state report discoveries and development wells of high caliber as the industry rounds out one of its finest drilling years in Oklahoma.

McClain County. Continental Oil Co. has a new discovery at 1 Pybas in C NE NW 31-7n-3w, northwest of Iron Chapel field.

The well flowed 261 bbl. of 43.9°-gravity oil per day on 20/64-in. choke with 411 M.c.f.d. Perforations are in the Hunton Siluro-Devonian at 9,914-24 ft. From lower Hart sand at 8,993-9,008 ft. the well made 64 bbl. on a 7-hour swab test. Tops include Woodford at 9,764 ft., Hunton 9,900 ft., Sylvan 10,270 ft., Viola 10,373 ft., First Bromide 10,842 ft., and Second Bromide at 10,898 ft. Total depth is 10,948 ft.

Major County. Sun Oil Co. 1 Culp is a new gas producer in Cedardale field, northwestern Oklahoma.

The Culp well, S½ N½ S½ 17-22n-16w, flowed 1,193 M.c.f.d. from Layton sand perforations at 6,138-72 ft. on 14/64-in. choke. It flowed 4,165 M.c.f.d. on 20/64-in. choke, 4,810 M.c.f.d. on 24/64-in. choke, and 5,690 M.c.f.d. on 28/64-in. choke. On ½-in. choke it flowed 6,352 M.c.f.d. Open flow was set at 9 M.M.c.f.d.

In C NW SE 18-20n-11w, North Homestead field, Kingwood Oil Co. 1 Krause flowed 2,465 M.c.f.d. on 13/64-in. choke from Red Fork Pennsylvanian perforations at 7,147-72 ft. and 5 bbl. condensate per hour. From Chester Mississippian at 7,283-7,340 ft. it made 4,830 M.c.f.d. and 3 bbl. condensate per hour.

Kingfisher County. United Producing Co. dually completed 2 Michel in C SW SW 29-19n-6w, East Hennessey field, flowing 600 bbl. of oil per day on 24/64-in. choke from Manning perforations at 6,776-6,801 ft.; 25 bbl. per day from open hole in Meramec at 7,001-98 ft. Jones & Pellow 1 Yeoman, C NE NW 24-18n-7w, North Dover field, flowed 732 bbl. daily on 17/64-in. choke from Manning at 6,938-76 ft.

British-American 1 Bollenback, C SE NW 27-17n-5w, Southeast Lincoln field, flowed 105 bbl. in 8 hours on ¼-in. choke from open hole in Meramec at 6,544 ft. to 6,882 ft. From Oswego at 6,244-64 ft. it made 49 bbl. in 8 hours on ¼-in. choke.

Murray County. In southern Oklahoma, Continental Oil Co. is testing at 1 Giles in SE NW SE 33-1n-2e, between Davis and Sandy Creek fields. The well made 229 bbl. of oil per day on 8/64-in. choke from Second Bromide sand at 4,686-88 ft.

Panhandle. In North Fork field, Beaver County, Union Oil Co. of California completed 1-22 Mercer in C NW SW 22-1n-25eCM, flowing 486 bbl. of oil per day on 10/64-in. choke. from perforations in the Tonkawa Pennsylvanian at 6,161-67 ft.

Garvin County. Fain-Porter Drilling Co. finaled 1 Neal-Mays in C NE SE 11-4n-2w, north of East Maysville field.

The Deese discovery flowed 30 bbl. of oil hourly on ½-in. choke from perforations at 5,490-5,515 ft.

Canadian County. Tidewater Oil Co. has a gas discovery at 1 Yellow in C NW SE 28-14n-9w, northwest of Calumet.

The Atoka Pennsylvanian discovery flowed 1,692 M.c.f.d. on ⅜-in. choke from perforations at 9,668-9,740 ft.

Kansas adds several extensions

FIELD DEVELOPMENT was brisk in Kansas last week with important extensions reported in several areas.

In Stafford County, Petroleum Inc. 1 Wilson "W," SW SW 18-25s-14w, ½ mile west of Foley field, opened Mississippian oil production in the area. Swab got 50 bbl. of oil per day, no water, from perforations at 4,202-14 ft. The field formerly had Lansing and Viola production, and Mississippian gas.

Hamilton Brothers Inc. have a dual Keyes and Morrow Pennsylvanian gas discovery in Greenwood gas area, Morton County, Southwest Kansas.

The 1-2 Dean in NW SE SE 2-32s-42w, 3½ miles northwest of Richfield, flowed 1,850 M.c.f.d. from Morrow "G" sand at 4,974-94 ft. and 2,200 M.c.f.d. from Keyes sand at 5,051-54 ft.

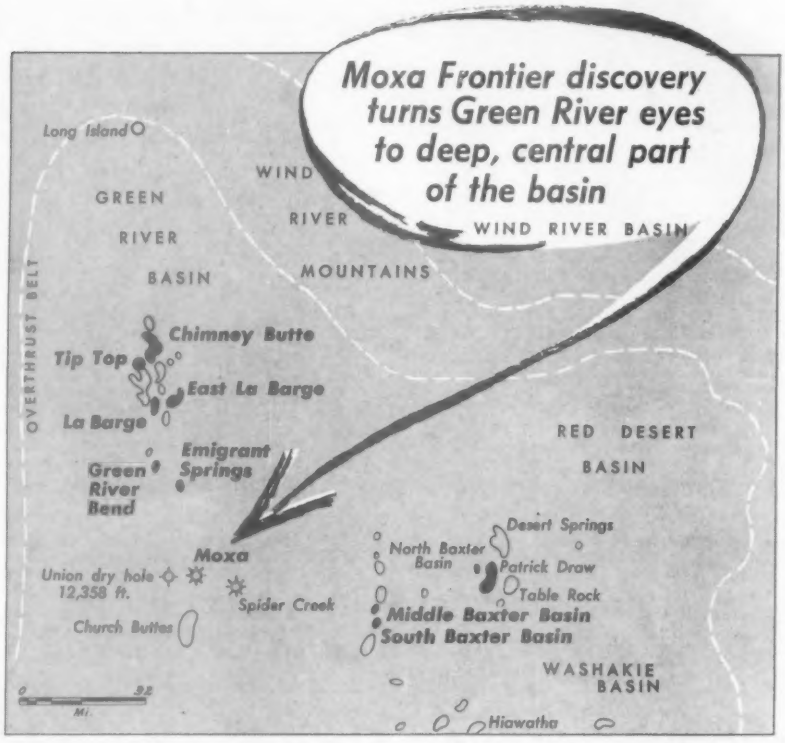
Anadarko Production Co. completed 1 Light "A," C NW SW 16-35s-43w, West Elkhart field, flowing 12 M.M.c.f.d. from perforations in the upper Morrow at 4,300-5 ft.

Kenneth Rupp and Benedict Oil Associates completed 1 Robbins-Gallup unit in NE SW SW 18-31s-15w, 1½ miles east of Robbins Ranch field, Barber County, as a Mississippian oil discovery. The well made 65 bbl. of oil per day from perforations at 4,706-27 ft.

Arbuckle outpost. Nadel and Gussman and Thunderbird Drilling Co. completed an Arbuckle Cambro-Ordovician discovery at 1 Wood in NW NW NW 25-19s-13w, 2 miles east of Great Bend, Barton County. The well made 239 bbl. per day from open hole at 3,414-18 ft. The 2 Wood is now drilling in NE NE NE 26-19s-13w.

Ferguson Oil Co. 1 Friesen "B" unit, C SE SW 3-33s-28w, North Borchers field, Meade County, flowed 2,500 M.c.f.d. on drill-stem test of the Morrow at 5,616-60 ft.

Evalyn field. Falcon Seaboard Drilling Co. has its third Chester Mississippian sand oil well in Evalyn Morrow gas and Chester oil field, Seward County, 10 miles north of Liberal. The 1-A Arnold, C NW NW 10-33s-33w, flowed 71 bbl. of oil in 7 hours through 1-in. choke from perforations at 5,993-6,009 ft.



A RECENT Frontier Cretaceous gas discovery in the deep central confines of Green River basin forces a new look into this southwestern Wyoming region where Mesaverde rocks have been the prize in recnt years. Bold-face fields are those with Frontier production.

Year's big find for Green River reported

THE YEAR'S most important discovery in Wyoming's Green River basin is Texaco Inc. 1 Moxa unit in NE SE 22-19n-112w, Sweetwater County. This well was completed flowing 1,300 M.c.f.d. from Frontier Upper Cretaceous at 11,416-56 ft., opening up the entire central part of the Green River basin to pre-Mesaverde exploration.

Remote test. Texaco's new gas find in the Frontier sands lies about one-third of the way along a 35-mile north - south line between Church Buttes Dakota Cretaceous field and Emigrant Springs, nearest Frontier production. There has been very little drilling in this part of the basin. The only deep hole ever drilled was 2 miles west at Union Oil Co. of California's 1949 wildcat, dry at 12,358 ft. The well topped the Frontier sand at —4,922 ft., but there were no tests in that formation.

Texaco took the Moxa well to 14,000 ft. and Nugget Jurassic. It plugged back for completion as a Frontier gas discovery with no significant shows reported down the hole. The well is the first on the 15,323-acre Moxa unit. Continental Oil Co. and Union Pacific hold other interests here.

Most exploration in the past few years in Green River basin has been east of the Rock Springs uplift in the Red Desert region. Here big and fast - developing fields like Patrick Draw and Desert Springs have sprung up with Mesaverde Almond Upper Cretaceous production. The Frontier has never been attacked heartily in the basin except in the LaBarge and Baxter basin areas. The Moxa unit discovery plus the Emigrant Springs field to the north should put Frontier at the top of the list for drillable prospects in the deep central part of Green River basin.

Another remote find. Humble Oil & Refining Co. 1 Spider Creek unit,

Green River basin oil and gas field data—To Jan. 1, 1961 only

Field, County, and Year of Discovery—	Pay zone	Age of Pay	No. of Wells
1. Arch Unit, Sweetwater, 1959	Almond 5,728	U. Cretaceous	2 gas
2. Aspen, Uinta, 1903	Bear River 822	L. Cretaceous	Abd.
3. Baxter Basin Middle, Sweetwater, 1938	Frontier 1,900	U. Cretaceous	11 gas
	Dakota 2,470	U. Cretaceous	
	Lakota 2,700	L. Cretaceous	
4. Baxter Basin North, Sweetwater, 1926	Dakota 2,950	U. Cretaceous	31 gas
	Morrison 3,500	Jurassic	
	Nugget 4,000	Jurassic	
5. Baxter Basin South, Sweetwater, 1922	Frontier 2,345	U. Cretaceous	28 gas
	Dakota 3,830	U. Cretaceous	
	Lakota 3,995	L. Cretaceous	
6. Big Piney, Sublette, 1938	Wasatch 900	Tertiary	21 oil
	Almy 2,288	Tertiary	33 gas
	Mesaverde 3,075	U. Cretaceous	
7. N. Big Piney, Sublette, 1953	Almy 2,709	Tertiary	1 gas
8. S. Big Piney, Sublette, 1953	Hilliard 2,692	U. Cretaceous	Comb. Big Piney, 1959
9. Birch Creek, Sublette, 1957	Bear River 7,543	L. Cretaceous	6 gas
10. Canyon Creek, Sweetwater, 1941	Wasatch 2,960	Tertiary	12 gas
	Mesaverde 5,460	U. Cretaceous	
11. Chimney Butte, Sublette, 1957	First Frontier 6,782	U. Cretaceous	9 gas
	Second Frontier 7,554	U. Cretaceous	
	Bear River 8,140	L. Cretaceous	
12. Church Buttes, Sweetwater, 1946	Dakota 12,550	U. Cretaceous	13 gas
13. Desert Springs, Sweetwater, 1958	Mesaverde 5,890	U. Cretaceous	13 gas
14. W. Desert Springs, Sweetwater, 1959	Almond 3,818, 3,554	U. Cretaceous	11 oil, 6 gas
15. Dry Piney New, Sublette, 1957	First Frontier 6,254	U. Cretaceous	2 gas
	Second Frontier 6,810	U. Cretaceous	
16. Emigrant Springs, Lincoln, 1958	Second Frontier 10,438	U. Cretaceous	4 gas
17. Green River Bend, Lincoln, 1958	Second Frontier 7,002	U. Cretaceous	6 gas
18. Green River Bluffs, Sublette, 1959	Fort Union 4,240	Tertiary	1 gas
19. Hiawatha, Sweetwater, 1928	Wasatch 2,240	Tertiary	17 gas, 1 oil
	Fort Union 4,100	Tertiary	
20. Hogsback, Sublette, 1955	Frontier 6,453	U. Cretaceous	16 gas
21. Joyce Creek, Sweetwater, 1959	Dakota 4,096	U. Cretaceous	1 oil, 1 gas
22. LaBarge, Lincoln-Sub., 1924	Wasatch 650	Tertiary	121 oil, 4 gas
	Second Frontier 7,243	U. Cretaceous	
	Muddy gas 7,697	L. Cretaceous	
23. E. LaBarge, Sublette, 1959	Second Frontier 7,100	U. Cretaceous	5 gas
24. N. LaBarge, Sublette, 1928	Hilliard 1,180	U. Cretaceous	18 oil
25. Little Worm Creek, Sweetwater, 1959	Lakota 3,882	L. Cretaceous	2 gas, 1 oil
	Morrison 3,905	Jurassic	
26. Middle Mountain, Sweetwater, 1952	Mesaverde 6,534	U. Cretaceous	2 gas
27. Patrick Draw, Sweetwater, 1959	Almond 5,175	U. Cretaceous	134 oil
28. Pinedale, Sublette, 1955	Fort Union 9,424	Tertiary	3 gas
29. Pioneer, Sweetwater, 1959	Almond 4,757	U. Cretaceous	1 gas
30. Playa Unit, Sweetwater, 1958	Lewis 4,233	U. Cretaceous	3 gas
	Mesaverde 5,410	U. Cretaceous	
31. Potter Mtn., Sweetwater, 1956	Lakota 7,246	L. Cretaceous	1 gas
32. Salt Wells, Sweetwater, 1949	Dakota 6,262	U. Cretaceous	2 gas
33. State Line, Sweetwater, 1959	Wasatch 2,710	Tertiary	11 gas
34. Table Rock, Sweetwater, 1947	Fort Union 3,381	Tertiary	10 gas, 6 oil
	Mesaverde 5,578	U. Cretaceous	
	Almond 6,638	U. Cretaceous	
35. SW Table Rock, Sweetwater, 1955	Lewis 5,711	U. Cretaceous	1 gas
36. Tip Top, Sublette, 1951	Nugget 9,682	Jurassic	14 gas, 3 oil
	First Frontier 5,970, g	U. Cretaceous	
	Second Frontier 6,660, g	U. Cretaceous	
	Third Frontier 7,230, g	U. Cretaceous	
37. Trail, Sweetwater, 1958	Mesaverde gas 4,827	U. Cretaceous	6 gas
38. Wamsutter, Sweetwater, 1958	Almond 9,594	U. Cretaceous	1 gas

NE SW 26-18n-110w, Sweetwater County, is another important wildcat discovery for this part of Green River basin.

The well flowed 4,220 M.c.f.d. on a drill-stem test in the Mesaverde at 9,080-9,126 ft. Nearest Mesaverde production is 40 miles east on the Rock Springs uplift. Spider Creek with its 110,251 acres is the second largest ever assembled in Wyoming.

Basin is active. Green River is one of the most active areas in the Rockies. Since the first of 1960, 23 new oil and gas fields have been opened throughout the Sublette-Lincoln-Uintah-Sweetwater County area in the southwestern part of Wyoming. Some of the best in the state are among these—Patrick Draw and Desert Springs.

Until the middle 1950's, Green River was one of the most unexplored basins in Wyoming. A few well-known names like Church Buttes and LaBarge were soon to be crowded with new fields, particularly gas, upon completion of pipeline facilities out of the basin to the northwest. Since discovery at LaBarge in 1924, the basin has added 60 new oil and gas fields. Nearly half of these have been added in the past 1½ years.

Two sides of the basin have been catching most of the drilling play—the far-northern LaBarge-Tip Top area, and the Red Desert - Patrick Draw area. Emphasis has been on Tertiary and Mesaverde Upper Cretaceous rocks. The Moxa unit Frontier discovery will be watched with interest for a possible new drilling trend toward pre-Mesaverde objectives in the southwestern part of Wyoming.

Horizon breakdown of new Green River fields

Frontier Cretaceous	3
Nugget Jurassic	1
Mesaverde Cretaceous	3
Morrison Jurassic	1

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2100
Gardner-Denver Drawworks
15,000′ on down—2100 H.P.

Almond Cretaceous	8
Ericson Cretaceous	1
Fort Union Tertiary	1
Dakota Cretaceous	1
Wasatch Tertiary	2
Fox Hills Cretaceous	1
Lewis Cretaceous	1
Total new fields	23

Fields with Frontier sand production in Green River basin

1. Middle Baxter Basin
2. South Baxter Basin
3. Chimney Butte
4. Tip Top
5. Dry Piney New
6. Emigrant Springs
7. Green River Bend
8. LaBarge
9. East LaBarge
10. 35-28n-114w
11. Moxa Unit

Generalized stratigraphic section of Green River producing horizons

Tertiary	Eocene	Wasatch
Tertiary	Paleocene	Almy
		Fort Union
Upper Cretaceous	.....	Fox Hills
		Lewis
		Mesaverde group (Almond, Ericson, Rock Springs)
		Hilliard
		Frontier
		Dakota
Lower Cretaceous	.....	Lakota
		Bear River
		Muddy
Jurassic	.....	Morrison
		Nugget

Discoveries in Green River basin . . . 1960 through November 1961

1. Lincoln County: Belco Petroleum Corp. 3 Emigrant Springs unit, SE SE 15-23n-112w. IPF 2,354 M.c.f.d., Frontier Cretaceous 10,480-10,529 ft. TD 10,657 ft. 1960.

2. Sublette County: General Petroleum Corp. 13-31 Unit, NE SW NW 32-35n-65w. IPP 250 BOPD, Nugget Jurassic 11,020-30 ft. New oil discovery in Hogsback field. TD 11,080 ft. 1960.

3. Sublette County: Raymond I. Smith 2 Mickelson Creek unit, SW NW 29-32n-114w. IPF 360 BOPD, Mesaverde Cretaceous 3,536-49 ft. TD 4,271 ft. Oil discovery of Mickelson Creek field. 1960.

4. Sublette County: Belco 1 DPU-8 Government, SE 35-28n-114w. IPF 7,176 M.c.f.d., Second Frontier sand 7,370 ft. TD 7,602 ft. Gas discovery. 1960.

5. Sweetwater County: Caulkins Oil Co. 1-9-W Federal, NW NW 9-14n-100w. IPF gas, no gage. Mesaverde 7,729-7,831 ft. TD 8,357 ft. 1960.

6. Sweetwater County: Caulkins 42-18 Black Butte Creek, SW SE NE 18-19n-102w. IPF 2,100 M.c.f.d., Morrison Jurassic 4,668-4,714 ft. TD 5,020 ft. Gas discovery. 1960.

7. Sweetwater County: Gulf Oil Corp. 1 Leon, NE SE 18-19n-99w. IPF 339 M.c.f.d., Almond Cretaceous 3,342-79 ft. TD 3,730 ft. Gas discovery. 1960.

8. Sweetwater County: Superior Oil Co. 1-17 O'Donnel-Government, NW NW SW 17-13n-100w. IPF 500 M.c.f.d., Ericson Cretaceous 5,894-5,920 ft. TD 7,433 ft. Gas discovery. 1960.

9. Sweetwater County: Texas National Petroleum Co. 1-20 Government, NE SE 20-20n-99w. IPF 550 M.c.f.d., Almond 3,820-3,985 ft. TD 4,223 ft. Gas discovery. 1960.

10. Sweetwater County: Texas National 1-34 Government, NE NW 34-20n-99w. IPF 940 M.c.f.d., Almond sand 4,164-96 ft. TD 4,454 ft. Gas discovery. 1960.

11. Sweetwater County: Mountain Fuel Supply Co. 1 Jackknife Springs unit, NW SW NW 11-16n-101w. IPF 7,220 M.c.f.d., Mesaverde 5,335-64, 6,178-6,206, 6,316-36 ft. TD 6,680 ft. Gas discovery of Jackknife Springs field. 1960.

12. Sweetwater County: Forest Oil Corp. et al. 19-1 UPRR Arch, SE SW 19-19n-98w. IPF 607 BOPD, Almond 5,066-90 ft. TD 5,564 ft. Oil extension to Patrick Draw field. 1960.

13. Sweetwater County: Union Pacific Railroad Co. 13-31 Patrick Draw-Government, NW SW 31-19n-98w. IPF 202 BOPD, Almond 5,218-42 ft. TD 5,554 ft. Oil extension to Patrick Draw field. 1960.

14. Sweetwater County: Gulf 5 State Line unit, SW NW 18-12n-94w. IPF 444 BOPD, Fort Union Tertiary 3,934-45 ft. TD 4,464 ft. New oil pay in State Line field. 1960.

15. Sweetwater County: Continental Oil Co. 5-2 Sand Butte unit, NW NE 5-17n-99w. IPF 6,143 M.c.f.d., Almond 4,816-30 ft. TD 5,125 ft. Gas discovery of Sand Butte field. 1960.

16. Uinta County: Max Pray 1 Government-Akridge, NW NW 19-15n-112w. IPF gas, no gage. Dakota Cretaceous 12,902-22 ft. Gas discovery of Grizzly Buttes field. 1960.

Discoveries this year

1. Sublette County: Belco Petroleum Corp. 2 LIU, NW NE 35-29n-112w. IPP 28 BOPD, 4 BWPD, Wasatch Tertiary, 4,393 ft. Oil discovery of Long Island unit field.

2. Sweetwater County: Chandler & Simpson 1 Winegar-Government, SW NE 12-20n-100w. IPF 8,500 M.c.f.d., Almond 3,300 ft. New gas field.

3. Sublette County: Belco 1 Star Corral unit, NW NW 16-30n-113w. IPF 840 M.c.f.d., Wasatch 1,627-2,214 ft. TD 4,505 ft. Wasatch discovery in Big Piney area.

4. Sweetwater County: Texas National 1-8 Federal, C NE NW 8-19n-98w. IPF 8 M.M.c.f.d., Fox Hills Cretaceous 3,739-45 ft. TD 5,604 ft. Fox Hills discovery, new pay at Patrick Draw field.

5. Sweetwater County: Chandler & Simpson 1 Verbrugge-Government, C SE NE 2-18n-100w. IPF 1,500 M.c.f.d., 6 BCPD, Almond 2,367-71 ft. TD 2,844 ft. Almond discovery, new field.

6. Sweetwater County: Stateswide Oil Co. et al. 1-10 Government, NE NE 10-21n-99w. IPF 720 M.c.f.d., Lewis Cretaceous 3,848-58 ft. TD 5,185 ft. Lewis discovery, new field.

7. Sweetwater County: Texaco 1 Moxa unit, NE SE 22-19n-112w. IPF 1,300 M.c.f.d., Frontier 11,416-56 ft. TD 14,000 ft. New gas field.

Offset completed in Ohio's Salt Creek

In Ohio the first offset, located about 1 mile southwest of Ohio Fuel Gas Co. 1 M. J. Coblentz new pool discovery in Salt Creek Township, Holmes County, has been completed with natural production of 5,330 M.c.f.d.

The operator, J. A. Chapman, reported the Clinton sand in 1 D. A. Fry, Section 13, was topped at 3,767 ft. and drilled to 3,777 ft. Rock pressure gage was 1,380 psi.

The first test, of a series recently announced by Continental Oil Co. and H. H. & R. Drilling Co. to be made in southern Ohio, has been launched in Wilkesville Township, Vinton County. Reported depth to date of 1 Samuel Ponn heirs, Section 15, is 1,400 ft.

New Mexico taps gas-condensate pay

A Pennsylvanian gas-condensate discovery was completed in southwestern Lea County, Southeast New Mexico. Pan American Petroleum Corp. completed 1 Mary Nellis-Federal in 5-19s-33e, 1½ miles south of Buffalo field and 14 miles southeast of Maljamar townsite.

Flow was 1,680 M.c.f.d. plus 38 bbl. condensate per million on test through 26/64-in. choke. Perforations were at 13,324-59 and 13,412-25 ft. in Pennsylvanian. Top of the Strawn was 12,119 ft.

Dual-zone discovery finaled on Montana's Cedar Creek

The Cedar Creek anticline in eastern Montana has its second discovery of the year. It is Texaco Inc. 1 NP-G (NCT-12), NE SW 17-16n-55e, Dawson County.

Texaco completed the well pumping 276 bbl. of 42.1°-gravity oil per day, 3.4% water cut from Interlake Silurian perforations at 9,137-46 ft. and 26 bbl. per day from Red River Ordovician at 9,718-33 ft. Nearest production is 2 miles north at Woodrow field (Madison Mississippian). Sand Creek field, 3 miles southeast, has both Silurian and Ordovician oil.

The year's first find in the area was at Shell 1-NP M-12-15 NP, 2 miles south of Cabin Creek field in SW NW 15-9n-58e.

Gas flows at Utah's new Bitter Creek unit strike

The 1 Bitter Creek unit, a DeKalb Petroleum Co. well in SE NW 34-10s-22e, Uintah County, Uinta basin, Utah, flowed 20 M.M. c.f.d. after acid from a notch at 5,031 ft.

Tests continue at this 5,000-ft.

Wasatch Tertiary test. This new field opener lies between Ute Trail gas field on the north and Rock House unit on the southeast. Nearest production is at Ute Trail, 2½ miles north. The area between Bitter Creek and both Rock House and Ute Trail hasn't been drilled.

Mesa County, Colorado. A western Colorado wildcat was completed from Corcoran Mesaverde Cretaceous at 3,438 to 3,492 ft. The well is Apache Corp. and Petroleum Inc. 1 U. S.-Moran in C SW NE 28-10s-96w. Flow was 1,200 M.c.f.d. on 5/16-in. choke.

DISCOVERIES

West Central Texas

Shackelford County:
Wayne Petroleum Co. et al. 1 B. V. Midkiff et al. OWDD, 6½ miles northeast of Moran in Sec. 6, BOH Sur. IPF 240 BOPD, 25/64-in. choke, Miss. lime 4,256-98 ft., GOR 1,200:1, CP 900 psi., TP 450 psi. TD 4,374 ft. New oil discovery.

Throckmorton County:
Darden & O'Donohue 1 O. L. Kunkel, 9 miles west of Woodson in Sec. 1, SPRR Sur. A-252. IPP 17 BOPD, 36°, 754-764 ft. TD 799 ft. New oil discovery.

Wyoming

Campbell County:
McCulloch Oil of California 1 Government-Gentry, SW NW 3-56n-69w. IP swabbed 480 BOPD, Minnelusa Pennsylvanian 5,384-86 ft. TD 5,582 ft. Minnelusa discovery, new field.

Crook County:
Shell Oil Co. 1 Fowler, C SW NW 7-54n-67w. IPP 420 BOPD, Minnelusa discovery, new field, 6,033-35 ft. TD 6,180 ft.

Oklahoma

Blaine County:
Texaco Inc. 1 O. P. Ruth, C NE SW 34-15n-12w, 5 miles south of South Watonga field. IPF 691 M.c.f.d. and 1 BCPD, 16/64-in. choke, FTP 1,200 psi., 58°, Morrow 10,484-10,535 ft. TD 11,018 ft. PB 10,540 ft. New gas discovery.

Kansas

Barber County:
Kenneth Rupp and BOA 1 Robbins-Gallup unit, NE SW SW 18-31s-15w, 1½ miles east of Robbins Ranch field. IPP 65 BOPD, 41°, Miss. 4,706-27 ft. TD 4,806 ft. New oil discovery.

(More Field Tables on Page 162)

October well tally highest since May at 4003

State—	Total	Oil	Cond.	Gas	Dry	Service	Footage	Cum. wells 1961	Cum. footage 1961	Cable-tool comp.	D.D.
Alabama	1	1	0	0	0	0	11,450	33	365,701	0	0
Alaska	8	2	0	1	5	0	77,519	40	409,779	0	0
Arizona	1	0	0	0	1	0	876	19	44,181	0	0
Arkansas	43	18	0	1	24	0	149,777	426	1,588,854	0	0
California	198	137	0	19	41	1	804,568	1,491	6,423,590	0	22
Colorado	77	5	2	24	46	0	366,017	547	2,603,729	0	0
Florida	1	0	0	0	1	0	7,871	8	76,491	0	0
Georgia	0	0	0	0	0	0	0	1	4,500	0	0
Illinois	235	78	0	2	82	73	570,093	1,716	3,817,699	27	5
Indiana	84	25	0	0	57	2	137,959	634	940,540	60	0
Kansas	348	171	0	15	150	12	1,096,102	4,044	10,578,106	61	5
Kentucky	147	37	0	34	73	3	251,752	1,573	2,194,155	92	0
Louisiana	326	131	8	50	137	0	2,283,864	3,171	23,568,248	0	1
North	161	63	0	28	70	0	556,500	1,324	4,436,756	0	0
South	138	57	8	19	54	0	1,436,436	1,400	14,448,859	0	1
Offshore	27	11	0	3	13	0	290,928	447	4,682,633	0	0
Michigan	87	15	0	7	47	18	268,905	660	2,008,752	27	0
Mississippi	52	22	0	2	28	0	518,721	453	4,489,854	0	0
Missouri	1	0	0	0	1	0	2,631	35	60,244	0	0
Montana	37	12	0	1	24	0	187,819	329	1,772,711	0	0
Nebraska	84	34	0	1	49	0	385,385	820	3,735,469	0	0
Nevada	0	0	0	0	0	0	0	14	27,398	0	0
New Mexico	177	74	0	58	45	0	944,442	1,519	7,855,832	33	2
West	80	16	0	54	10	0	402,689	662	3,226,523	14	2
East	97	58	0	4	35	0	541,753	857	4,629,309	19	0
New York	33	13	0	6	4	10	58,691	380	552,624	30	0
North Dakota	17	5	0	0	12	0	104,143	212	1,331,560	0	0
Ohio	115	61	0	19	32	3	257,092	883	2,211,260	93	0
Oklahoma	547	295	6	49	133	64	1,980,716	4,780	16,193,796	97	19
Oregon	0	0	0	0	0	0	0	2	15,295	0	0
Pennsylvania	63	28	0	19	5	11	171,910	527	1,559,512	54	0
South Dakota	0	0	0	0	0	0	0	5	30,908	0	0
Tennessee	0	0	0	0	0	0	0	65	49,593	0	0
Texas	1,132	616	14	118	348	36	5,413,523	11,952	53,674,691	37	13
District 1	92	46	0	2	44	0	221,984	766	2,066,677	0	1
District 2	53	11	2	16	24	0	413,852	629	4,246,328	0	2
District 3	83	49	1	8	25	0	556,463	946	6,387,639	0	0
District 4	115	40	2	29	44	0	719,764	1,011	5,765,414	0	0
East (5 & 6)	86	57	2	5	22	0	554,786	971	5,072,953	0	0
District 7-B	123	58	1	6	52	6	383,200	1,486	4,484,163	12	0
West (7-C & 8)	298	216	1	14	55	12	1,495,492	2,990	15,224,584	16	8
District 9	192	107	2	7	60	16	602,012	2,175	5,786,003	9	2
District 10	90	32	3	31	22	2	465,970	978	4,640,930	0	0
Utah	22	3	3	5	11	0	141,261	204	1,196,382	0	0
Virginia	0	0	0	0	0	0	0	2	8,004	0	0
Washington	1	0	0	0	1	0	3,009	11	44,404	0	0
West Virginia	88	15	0	65	8	0	206,176	868	2,129,579	72	0
Wisconsin	0	0	0	0	0	0	0	6	8,100	0	0
Wyoming	78	27	1	7	42	1	360,432	808	4,024,862	0	0
Total Oct. 1961	**4,003**	**1,825**	**34**	**503**	**1,407**	**234**	**16,762,704**	**38,238**	**155,596,403**	**683**	**67**
Total Sept. 1961	3,557	1,625	51	395	1,360	126	14,932,436	.....	.....	....	....
Cumulative 1961	**38,238**	**17,156**	**707**	**3,913**	**13,835**	**2,627**	**155,596,403**	.....	.....	**7,546**	**668**
Cumulative 1960	38,103	17,123	1,108	3,174	14,510	2,188	157,340,125	.....	.....	....	....

Robert G. Reed III . . . frowns on market-growth mania.

Tidewater's Reed comes up fast

New marketing manager for Tidewater is a young man who switched from wool importing to oil only 4 years ago.

THE MAN responsible for seeing that Tidewater Oil Co.'s Flying A products continue to fly high, wide, and profitable is Robert G. Reed III, who recently was named marketing manager for Tidewater.

Reed is a comparative newcomer to the oil business—he's only been with Tidewater 4 years—but he's made an impressive showing and moves into the firm's top marketing job with a good grasp of today's oil-marketing picture.

Reed got into the oil business in a peculiar manner. He was president of a family wool-importing business in Boston in 1957 when he decided there were greener pastures than the wool business. He hired a management consultant to help him select an industry with a bright future. The consultant recommended oil.

As a result, Reed stepped down as head of the Boston company and joined Tidewater's eastern division marketing department. He moved up to division marketing manager and assistant division general manager before assuming his present post.

Reed is not of the expansionists' school which characterizes some oil marketing executives of today. His plans are for Tidewater to build up strong position in present marketing areas rather than expand into new territories.

Tidewater may some day reenter the Mid-Continent market, but it's not in the immediate future.

The 34-year-old Tidewater manager says some companies are creating today's biggest marketing problem by their attempts to capture a bigger share of an existing market and expand into a new area through cutting prices. The gasoline market, he points out, is "inelastic" and doesn't get any bigger just because the price is more attractive to the consumer. The result is price chaos, not more gasoline sales.

Changes ahead. Tidewater's new marketing manager thinks some changes for the better are ahead in gasoline marketing.

He feels the experiments with new pricing plans are "healthy signs" that will alleviate some of the pricing problems which have beset the industry during the past year.

"Someone will strike the right formula," he says.

This "right formula" won't end price wars. There always will be price disturbances, but Reed does feel some new pricing method will evolve which will lead to new ground rules for pricing gasoline and a more stable market.

He also thinks it is inevitable that oil companies will change the way they sell their products. Service stations will remain the primary outlet, but some changes are apparent.

In this field, he points to the many pilot programs going on throughout the country where stations are offering food, insurance, mail-order catalog service, and many additional services.

The answer may be the super-service station which is replacing many neighborhood stations in some areas. Reed isn't picking any as a winner yet, but says something "which gives the motorist more than gasoline" will eventually be adopted.

However, Reed is quick to point out these added services are only a way to get the motorist into the station, and that the primary source of profit is still petroleum products, not the added services. The oil marketer who admits he can't sell his primary product at a profit is dead before he starts, Reed says.

Background. Reed is a native New Englander with an Ivy League background. He was born in Cambridge, Mass., and prepared at Phillips Academy, Andover , Mass., before going to college at Dartmouth, where he received a BA in economics.

He and his family have moved into a home in the Hancock Park area of Los Angeles, not too far from Tidewater's headquarters on Wilshire Boulevard.

●

Manuel B. Edquist has been elected a vice president of Pioneer Natural Gas Co. He will continue as manager of the company's Amarillo, Tex., division. Edquist has been with Pioneer and its predeces-

sors since 1935. **Jimmie J. Heitz,** petroleum engineer, has been promoted to manager of Pioneer's gas-supply department. Heitz was reservoir engineer with Mobil Oil Co. before joining Pioneer last year.

Tom F. Hill, assistant manager of Sun Oil Co.'s southwest production division, has been named division manager. He succeeds the late Sam M. Gladney. **Cecil A. Colville,** administrative assistant to southwest division management, will succeed Hill as assistant division manager. Hill was regional land superintendent in Dallas before becoming assistant general manager of the division in 1951. Colville was Sun's district operating superintendent in Midland, Tex., before moving to Dallas in 1959.

HILL

Charles M. Cross, manager of Honolulu Oil Corp.'s exploration department in San Francisco, has opened offices as consulting geologist in Palo Alto, Calif.

Kerr - McGee Oil Industries has divided its marketing area into three divisions in a realignment of branded marketing operations. **E. H. Sickles, Jr.,** has been named northern division sales manager in Minneapolis; **P. O. Morgan** has been named central division sales manager in St. Louis; and **W. N. Pritchett** has been named southern division sales manager, Oklahoma City. **S. K. Nelson** will be wholesale sales manager in Minneapolis, with **J. C. McClendon** as retail sales manager there. In St. Louis, **Clarence Shaw, Jr.,** will be wholesale sales manager and **J. B. Hartnett** will be retail sales manager. In Oklahoma City, **B. A. Brokaw** has been named wholesale sales manager, and **R. A. Mooney,** retail sales manager. In other appointments, **Theo D. Antonio,** assistant central division sales manager, will be in charge of the Indianapolis sales office. **R. B. Heuring** will serve in an advisory capacity to **H. H. Raborn,** vice president and general manager of marketing, in Oklahoma City. Heuring will be responsible for customer relations.

William L. Foley, geologist with Humble, has been transferred to Salt Lake City from Billings, Mont.

James F. Breen, land man with Hunt Oil Co., has been transferred to Tyler, Tex., from Williston, N.D.

A. Mitchell Belchic has joined the Bank of the Southwest, Houston, as manager of the new oil and gas section of the trust department.

George H. Ketchum has been named division land man for Mobil Oil Co.'s Los Angeles exploration and producing division.

J. G. Eckel, vice president and general manager of Dorchester Corp. in Amarillo, Tex., has been elected president of the company. He succeeds **James J. Flanagan,** New York.

W. H. Collins, assistant division development geologist for Phillips Petroleum Co. in Lafayette, La., has been promoted to assistant general natural-gas geologist and transferred to Bartlesville, Okla.

G. H. Doran has been named chairman of Nebraska Oil and Gas Conservation Commission. He succeeds **Fred Enders,** who will continue as a commission member. Doran and Enders were recently reappointed to 4-year terms on the commission.

W. Glenn Noell, geological engineer, and **Lewis R. Pomeroy III,** petroleum engineer, have joined H. J. Gruy & Associates, Dallas appraisal and reservoir engineering firm. Noell was with Dorchester Corp. and Pomeroy had been with Continental Oil Co., Eastern States Petroleum & Chemical Corp., and Stekoll Petroleum Corp.

W. J. Scott, district manager for Tidewater Oil Co., has been elected chairman of American Petroleum Institute's East Texas chapter. He succeeds **Leo Walker,** East Texas Salt Water Disposal Co. Elected vice chairmen of the group were **B. M. Davis,** Kilgore; **Hubert Burkleo,** Tyler; **Clay Creager,** Kilgore; and **J. G. Burton,** Kilgore. **John Newman,** Kilgore, was named secretary-treasurer, with **Bruce James,** Kilgore, as assistant secretary-treasurer.

Ralph Macon, manager of market and product development for Atlantic Refining Co. in Philadelphia, has joined Hooker Chemical Corp.'s international division as project manager, international development. He will headquarter in New York.

Herbert G. Officer, North American Royalties, has been elected president of North Dakota Independent Oilmen and Landowners Association. Other new officers are **Kye Trout,** independent, vice president; **John N. Klemer,** Harris, Brown & Klemer, secretary; and **I. J. Wilhite,** independent, treasurer.

W. M. V. Ash, president of Shell Oil Co. of Canada, Ltd., will become chairman of the company January 1. He will be chief executive officer. **Paul L. Kartzke,** executive vice president, will move up to president. He will be primarily concerned with the company's operating departments. **W. F. Mitchell,** Shell International Chemical, London, will succeed Kartzke as executive vice president of Shell of Canada. He will take charge of marketing activities. New assignment for **C. A. Foster,** formerly vice president of marketing, will be announced later. He will be with Shell Oil Co., New York.

ASH

KARTZKE

MITCHELL

C. T. Wright, general manager of Imperial Oil's marketing department, has been named executive assistant to the board on special marketing interests. **Douglas H. Cooper,** assistant general manager of marketing, will succeed Wright as general manager. **Howard W. Coxon,** manager of the Pacific marketing region, has been named deputy general manager of marketing.

PERSONALS

Fletcher F. Farrar, Farrar Oil Co., Mount Vernon, Ill., has been elected 1962 president of Illinois Oil and Gas Association. Other new officers include **J. D. Anderson,** Ohio Oil Co., Terre Haute, Ind., first vice president; **J. J. Shulman,** Shulman Brothers, Vandalia, Ill., second vice president; **R. C. Cooper,** Cities Service Petroleum Co., Olney, Ill., third vice president; **T. F. Lawry,** Mahutska Oil Co., Robinson, Ill., secretary; **Walter B. Price,** National Associated Petroleum Co., Mount Vernon, treasurer; **C. T. Smith,** Flora, Ill., independent, general counsel; and **Charles J. Pardee,** Mount Vernon, executive secretary.

FARRAR

Harold J. Matthews, production engineer for Union Oil Co. in Santa Paula, Calif., has been promoted to production supervisor in Santa Fe Springs, Calif.

Robert C. Edgar, manager of contracts, purchasing, and personnel for Brown Drilling Co., has been named vice president of the Long Beach, Calif., contracting firm. Edgar has been with Brown since 1955 and formerly served as operations manager of Venezuelan activities.

Charles H. Mottier, Jr., has been named special projects coordinator in American Oil Co.'s supply and transportation department. **George Prout,** assistant superintendent of the light-oils division at the Wood River, Ill., refinery, will succeed Mottier on executive assignment with **John E. Kasch,** general manager of supply and transportation.

Richard B. Cooper and **Charles H. Reese** have been named research engineers at California Research Corp.'s Richmond, Calif., laboratory. New research chemists at Richmond are **Arne H. Traaen, Dr. Lewis R. Honnen, Dr. Edgar F. Kiefer, and Dr. Klaus H. Altgelt. Donald H. Gray** has been named research engineer at the La Habra, Calif., laboratory. **Peter J. Helsdingen** has been named senior geophysicist, La Habra.

John H. Beard, geologist with Humble, has been transferred to Denver from Salt Lake City.

Lowell Redwine, formerly district geologist for Honolulu Oil Corp. in Bakersfield, Calif., has opened offices as consulting geologist in Bakersfield.

John B. Jacobs, district sales manager of Mobil Oil Co.'s Camden, N. J., district, has been named district sales manager of the Indianapolis resale district.

Charles Morgan, superintendent of Continental Oil Co.'s Denver refinery, will retire November 30. Morgan has been with Continental since 1922 and has served as superintendent of the Denver plant for 18 years.

Walter A. Guthrie, Michigan division manager of Mobil Oil Co., has been named chairman of the Associated Petroleum Industries of Michigan. He succeeds **William E. Slaughter, Jr.,** president of Aurora Gasoline Co. Slaughter had headed APIM since 1956.

Roland L. Forslund, assistant to the manager of regional sales for American Oil Co. in Chicago, has been named marketing manager for the Standard Oil division's Indianapolis region. He succeeds **Paul V. Troup,** recently named regional manager in New Orleans for American.

Carl A. Ballinger, senior planning associate in Ohio Oil Co.'s forward planning division, has been named special assistant to **Grant H. Young,** vice president of marketing. Ballinger will work with coordination of activities between Ohio and Speedway Petroleum Corp., Detroit, a subsidiary.

Charles E. Schleckser, head of Esso Research & Engineering Co.'s engineering-laboratory section, general engineering division, has been promoted to assistant director of the division. **William E. Meiers,** head of the corrosion and metallurgical-engineering group, has been named head of engineering-laboratory operations. **Edwin B. Kretzmer,** group head, has been named head of the new systems-engineering section.

Darrell G. Warner, engineer with Humble, has been transferred to Tulsa from St. Elmo, Ill.

Donald E. Jessup, geologist with Atlantic Refining Co., has been transferred to Midland, Tex., from Durango, Colo.

Herbert Gienger, production foreman for Farmers Central Exchange in Winkleman Dome field, Lander, Wyo., has been transferred to Gillette, Wyo., as production foreman.

John R. Cox, geologist with Petrobras, Brazilian state oil agency, in Maceio Alagoas, Brazil, has joined Skelly Oil Co. as geologist in Lafayette, La.

William H. Butt, Dallas area geologist for Atlantic Refining Co., will head Atlantic's new Australian subsidiary, Arco, Ltd., as vice president and resident manager. He will headquarter in Melbourne, Australia. Butt, who joined Atlantic in 1925, has had foreign assignments in Venezuela and Cuba. He was regional geologist for Kansas, Oklahoma, and the Texas Panhandle before becoming Dallas area geologist in 1954. The new appointment is effective January 1.

L. B. McMichael, superintendent of the northern California division for Standard Oil Co. of California, Western Operations, Inc., has been given a rotational assignment as assistant to the general manager, exploration department. He succeeds **W. P. Winham,** now retired after 39 years with California Standard.

Eugene Holman, retired chairman of Standard Oil Co. (N. J.), has been named recipient of Franklin Institute's Vermilye Medal for outstanding contributions to industrial management. Holman retired from Jersey last year after service as a director, vice president, member and chairman of the executive committee, president, and chairman.

John F. Wright, area refinery coordinator for Standard Oil Co. (N. J.) and a director of Esso Standard Italiana and Stanic Industria Petrolifera in Italy, has been named general refinery manager of Iranian Oil Refining Co. He succeeds **Frank E. Griffin,** who has been given a new assignment with Jersey Standard. Wright's appointment will be effective December 15.

WRIGHT

James T. Eberl, production engineer for Mobil Oil Co., has been transferred to Wichita from Ulysses, Kans.

J. H. Wagner, superintendent of Pan American Petroleum Corp.'s Pine Island area, Vivian, La., has retired after 39 years with the company. Wagner had been Pine Island area superintendent since 1951.

D. F. Presley, Lindsay, Okla., has been named district superintendent in charge of Cities Service Petroleum Co.'s production in the Fairway field of Anderson and Henderson counties, East Texas. He will headquarter in the company's new district production office, Tyler, Tex. **E. M. McGuire,** district petroleum engineer in Pampa, Tex., will be district engineer in Tyler. **O. C. Brown,** Longview, Tex., will be district clerk.

Norman B. Ross, production engineer with Honolulu Oil Corp. in Levelland, Tex., has joined Pure Oil Co. as production engineer in Dollarhide, Tex.

John B. Kett, Melvin L. Nelson, and **Raymond A. Wilke** have been named senior staff engineers in American Oil Co.'s general engineering department, Whiting, Ind.

J. M. Jones, manager of Continental Oil Co.'s Lake Charles, La., refinery, will retire November 30 after 35 years with the company. He has been manager in Lake Charles since 1950.

William E. Cannon and **Robert V. Heard** have been named area managers in Shamrock Oil & Gas Corp.'s sales department. Cannon will supervise sales in Arizona, New Mexico, Colorado, and Wyoming. Heard will manage the Texas, Oklahoma, Kansas, and Nebraska area.

Lloyd R. Lacy and **L. L. McWilliams** have formed McWilliams & Lacy, petroleum consulting firm, in Shreveport, La. The company will specialize in production management and operation, evaluation of properties, reservoir analysis, and secondary-recovery evaluation. Lacy was with Phillips Petroleum Co. 24 years before becoming a consultant in 1955. McWilliams is a former chief petroleum engineer and manager of planning and analysis for Mobil Oil Co. de Venezuela. He also was with Phillips at one time.

L. A. Doan, general manager of Dow Chemical Co.'s western division, has been named a director of Dow's Brazos Oil & Gas Co. division. **Calvin A. Campbell,** Dow vice president, has been named to the executive committee of the Dowell division. He succeeds **Luther Evans,** who will continue as a Dowell director.

John C. Robbins, Jr., has been named president of Mobil Oil Turk, AS, Mobil Exploration Mediterranean, Inc., and Mobil Refining, Inc., Mobil International Oil Co. affiliates in Turkey. He succeeds **J. W. McCullough,** who has returned to New York as marketing adviser for Mobil International. Robbins has been with the Socony Mobil companies since 1957. He was named administrative assistant to **Herman J. Schmidt,** president of Mobil International, early in 1960.

ROBBINS

Paul R. Schultz, former president of Blackwell Oil & Gas Co., Tulsa, has been appointed consultant for the oil division of American Metal Climax, Inc., with responsibility for the company's oil and gas operations. Schultz will continue to serve as a consultant to the Senate Interior Committee which will make a national fuels-policy study.

DEATHS

John W. Flude, Sr., 62, vice president and general manager of International Geophysical Exploration, Inc., died November 12 in Houston.

Carl Russ, 53, with Tenneco Oil Co. in East Orange, N. J., died November 15 after suffering a heart attack in a Chicago hotel. Russ had gone to Chicago to attend the annual API meeting.

Henry B. Van Dyne, 72, one of the founders of Pennsylvania Petroleum Association and Empire State Petroleum Association, died November 17. Van Dyne founded Van Dyne Oil Co. in Troy, Pa., in 1923, and later established branches in Elmira and Binghamton, N. Y.

Clyde Uhl, 82, pioneer Oklahoma and Kansas drilling contractor, died November 18 in a Bartlesville, Okla., hospital. Uhl retired in 1953.

George Frederickson, 87, retired vice president and a director of Oklahoma Natural Gas Co., died November 17 at his home in Oklahoma City.

J. William Robinson, 59, a vice president of Leeds & Northrup Co. and joint managing director of Leeds & Northrup, Ltd., England, died November 6 at his home in Birmingham, England. Robinson was president and a director of Leeds & Northrup Canada before moving to the English company earlier this year. He had been with the instrument manufacturing firms since 1924.

George MacDonald, 86, a director of Richfield Oil Corp., Cities Service Co. and Sinclair Oil Corp., died November 11 at his home in New York.

Cecil L. Cooper, 57, publisher of Midwest Oil Register, Tulsa, died November 21 in a Tulsa hospital after suffering a heart attack at his home. Cooper was with The Oil and Gas Journal's circulation department for many years before setting up his oil directory publishing firm in 1944.

High refinery runs push stocks above last year

BY JOHN C. CASPER

A quick look at the highlights . . .

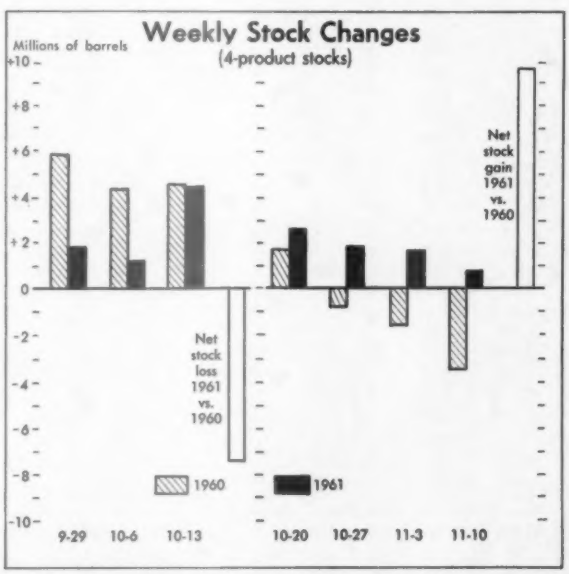
	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	7,209,560	UP	38,250	UP	76,407
Crude stocks	248,014,000	DOWN	2,752,000	UP	10,978,000
Completions	962	DOWN	9	DOWN	14
Refinery runs	8,170,000	UP	91,000	UP	183,000
Gasoline stocks	182,101,000	DOWN	183,000	DOWN	2,810,000
Kerosine stocks	36,591,000	DOWN	497,000	DOWN	242,000
Distillate stocks	178,483,000	DOWN	1,191,000	UP	3,156,000
Residual stocks	48,696,000	DOWN	827,000	UP	733,000
Four-product stocks	445,871,000	DOWN	2,698,000	UP	837,000
Total imports	1,788,800	DOWN	61,200	UP	176,200

HAVE YOU MADE a detailed study of your company's product stocks lately? If so, was there a definite shift in the past 7 weeks?

Here is a brief outline of changes in four-product stocks since September 22. On that date, major product inventories were about the same as they were a year ago.

Three weeks later, the four-product total was 7,374,000 bbl. lower than it was a year earlier. There had been increases in both years, but additions in 1961 were much less than in 1960.

The big shift in relative stock changes came near the middle of October, but there has been an unbroken trend toward larger net additions over the past 7 weeks. Here is the series. The following figures represent weekly changes in major-product stocks in 1961 minus changes in corresponding weeks of 1960. Starting with data for September 29, the differences for each week in millions of barrels were −4.1, −3.2, −0.1, +1.0, +2.0, +3.3, +3.5.



STOCK REDUCTIONS have been scarce this fall. The only one through November 10 was week of the hurricane.

Note the unbroken climb from minus 4 million barrels per week to plus 3.5 million per week. These numbers also represent differences between bars shown for each week on the chart.

The net gain for the last 4 weeks amounted to 9.8 million barrels. Compare it with a net reduction of 7.4 million barrels in the first 3 weeks.

Runs Show Gains Over Last Year

The small table at the bottom of the page shows higher refinery runs for 1961 in both periods covered by the chart. For the first 3 weeks, gains averaged 1,990,000 bbl. per week. In the second period, average input was up 1,743,000 bbl. per week over previous year. Increases in the second period averaged less than in the first and would not have produced the big stock shift if demand had followed last year's pattern. But, demand did not follow the 1960 pattern.

Refinery runs were a factor in that input was not adjusted to cover changes in demand. Take a look at the two periods. For the 3-week period ended October 13, demand for 1961 showed a gain of almost 16 million barrels over same period last year. Runs were up 6 million barrels, reductions in four-product stocks supplied better than 7 million, and the remainder came from other increases in supply plus withdrawals from minor product stocks.

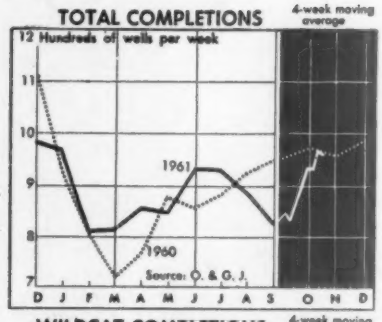
For 4-week period ended November 10, total demand was up only 1.4 million barrels from last year. Refinery runs were up almost 7 million barrels. The difference had to be adjusted in product storage.

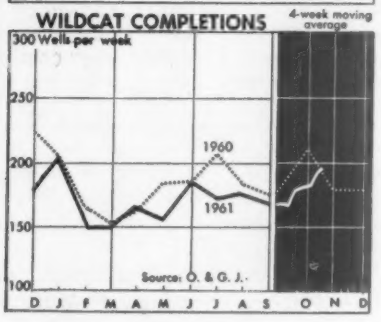
Refinery runs

(Thousands of barrels per week)

Week ended	1960	1961	Gain
September 29	55,643	56,707	1,064
October 6	55,160	57,085	1,925
October 13	55,286	58,268	2,982
Three-week total	166,089	172,060	5,971
October 20	55,629	58,555	2,926
October 27	55,538	57,022	1,484
November 3	54,810	54,838	28
November 10	54,019	56,553	2,534
Four-week total	219,996	226,968	6,972

Drilling





Active rotary rigs

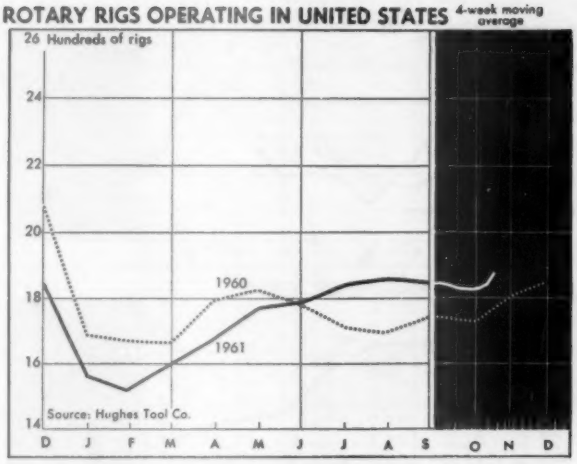
	10-20-61	10-13-61	10-21-60
Alabama	5	6	3
Alaska	7	7	8
Arkansas	17	18	12
Arizona	2	3	2
California	108	99	72
Land	102	94	69
Offshore	6	5	3
Colorado	33	28	44
Florida	1	1	4
Land	1	0	2
Offshore	0	1	2
Georgia	0	0	1
Illinois	47	47	40
Indiana	7	11	8
Kansas	115	116	135
Kentucky	6	4	6
Louisiana	303	279	288
North	45	43	39
S. Inland waters	103	105	103
S. Land	97	83	89
Offshore	58	48	57
Michigan	24	25	30
Mississippi	62	59	49
Missouri	2	2	1
Montana	25	26	22
Nebraska	25	25	23
Nevada	1	1	0
New Mexico	103	102	106
New York	2	2	2
North Dakota	16	15	9
Ohio	6	6	5
Oklahoma	198	205	209
Pennsylvania	8	5	7
South Dakota	1	1	1
Tennessee	1	1	0
Texas	644	650	665
S. Inland waters	13	12	11
S. Land	174	184	181
Offshore	2	1	3
North	63	62	54
Panhandle	42	47	60
East	68	71	50
West Central	178	165	174
West	104	108	132
Utah	42	40	32
Washington	1	0	1
West Virginia	14	13	8
Wisconsin	0	0	1
Wyoming	79	72	64
Total U. S.	**1,905**	1,869	1,858
Cum. avg. to date	1,738	1,734	1,737
Western Canada	159	146	147
Eastern Canada	1	1	0
Grand total	2,065	2,016	2,005

Hughes Tool Co. report.

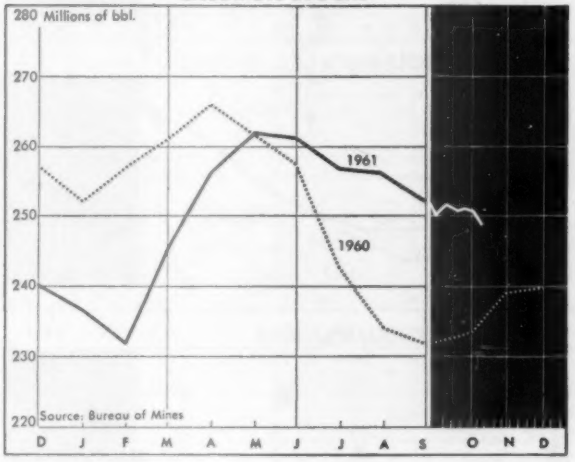
Weekly well completions . . . Week ended November 18, 1961

	Total wells							Cum.		Total wildcats					Cum.	
	Total	Crude	Cond.	Gas	Dry	Service	Footage	1961	1960	Total	Crude	Cond.	Gas	Dry	1961	1960
Arkansas	16	8	0	0	8	0	55,202	458	541	4	0	0	0	4	99	135
California	51	34	0	4	13	0	188,830	1,634	1,504	7	0	0	1	6	242	274
Colorado	15	1	0	7	7	0	64,421	590	585	6	0	0	0	6	262	295
Illinois	40	16	0	0	24	0	97,730	1,816	2,069	17	4	0	0	13	423	439
Indiana	19	8	0	0	11	0	29,808	685	950	7	1	0	0	6	188	341
Kansas	69	33	0	5	30	1	240,208	4,224	3,589	18	3	0	1	14	783	929
Kentucky	12	6	0	0	6	0	16,581	1,622	1,940	0	0	0	0	0	116	207
Louisiana	107	46	0	22	39	0	703,678	3,433	3,228	23	1	0	1	21	586	497
North	56	20	0	14	22	0	178,916	1,467	1,255	13	1	0	0	12	287	239
South	45	25	0	8	12	0	475,343	1,497	1,527	9	0	0	1	8	249	227
Offshore	6	1	0	0	5	0	49,419	469	446	1	0	0	0	1	50	31
Michigan	23	6	0	3	14	0	67,981	716	843	7	0	0	0	7	254	229
Mississippi	19	6	0	1	12	0	192,055	498	603	7	1	0	0	6	178	223
Montana	15	8	0	0	7	0	66,142	360	303	5	0	0	0	5	167	144
Nebraska	27	8	0	0	18	1	125,883	878	790	11	0	0	0	11	435	344
New Mexico	28	14	0	9	4	1	147,043	1,610	1,661	3	1	0	0	2	266	232
West	12	2	0	9	1	0	60,389	700	600	1	0	0	0	1	89	65
East	16	12	0	0	3	1	86,654	910	1,061	2	1	0	0	1	177	167
North Dakota	6	1	0	0	5	0	27,138	231	260	5	0	0	0	5	66	75
Ohio	26	18	0	2	5	1	53,702	948	952	0	0	0	0	0	39	45
Oklahoma	122	55	4	13	29	21	475,520	5,132	4,096	8	1	0	0	7	474	630
Texas	288	132	1	45	99	11	1,325,298	12,770	13,833	64	8	0	4	52	2,742	2,829
Dist. 1	17	4	0	2	11	0	51,275	823	972	5	0	0	0	5	320	350
Dist. 2	24	6	0	7	11	0	157,407	678	669	9	0	0	2	7	205	166
Dist. 3	25	8	0	8	9	0	131,940	1,009	1,048	9	2	0	0	7	206	196
Dist. 4	11	6	0	4	1	0	62,589	1,083	953	4	2	0	1	1	303	262
East	15	9	1	2	3	0	105,095	1,020	1,162	5	1	0	1	3	267	237
Dist. 7-B	33	15	0	5	13	0	108,181	1,577	1,959	5	1	0	0	4	441	556
West	67	42	0	1	21	3	361,015	3,196	3,554	17	1	0	0	16	627	559
Dist. 9	64	30	0	2	24	8	200,998	2,340	2,582	7	1	0	0	6	257	450
Dist. 10	32	12	0	14	6	0	146,798	1,044	934	3	0	0	0	3	116	53
Utah	6	0	0	0	6	0	39,331	213	210	5	0	0	0	5	99	77
West Virgina	30	3	0	24	3	0	77,207	904	774	0	0	0	0	0	7	9
Wyoming	33	6	0	10	16	1	166,788	878	933	9	0	0	1	8	338	381
Misc. *(Ala. Alaska)	10	7	0	0	3	0	109,259	1,231	1,186	3	0	0	0	3	245	216
Total U. S.	**962**	416	5	145	359	37	4,269,805	40,831	40,850	**209**	20	0	8	181	8,009	8,561
Previous week	971	458	5	106	383	19	4,085,516	.....	.....	212	21	0	9	182	.....	.....
Cum. 1961	40,831	18,298	718	4,241	14,844	2,730	166,637,644	.....	.....	8,009	710	81	363	6,855	.....	.....
Cum. 1960	40,850	18,429	1,181	3,448	15,496	2,296	168,662,844	.....	.....	8,561	778	93	287	7,403	.....	.....
Western Canada	41	23	0	12	6	0	202,125	2,035	2,044	3	0	0	2	1	470	534

ROTARY RIGS OPERATING IN UNITED STATES



CRUDE-OIL STOCKS



Crude-oil stocks by states of origin*

(Thousands of barrels)

	11-11-61	11-4-61	11-12-60
Pennsylvania	2,291	2,294	2,301
Other Appalachian	1,362	1,494	1,400
Illinois, Indiana, Michigan	9,681	9,909	9,046
Nebraska and North Dakota	3,054	2,968	2,936
Kansas	9,267	9,171	9,014
Oklahoma	16,795	17,018	15,430
Arkansas	1,760	1,745	1,878
Louisiana	19,357	20,419	18,096
North	2,918	3,083	2,879
South	16,439	17,336	15,217
Mississippi, Alabama, Florida	3,271	3,400	1,971
New Mexico	9,609	9,586	8,812
Texas	104,770	106,664	98,837
East Texas	8,272	8,269	7,258
West Texas	47,133	47,556	47,156
Texas Gulf	18,982	18,375	17,859
Other Texas	30,383	32,464	26,564
Wyoming	16,333	16,086	15,352
Other Rocky Mountain	10,177	10,046	10,123
California	23,322	23,724	25,955
Foreign	†16,965	16,242	14,495
Total	**248,014**	250,766	235,646

*Bureau of Mines. †Includes 4,672,000 bbl. in California.

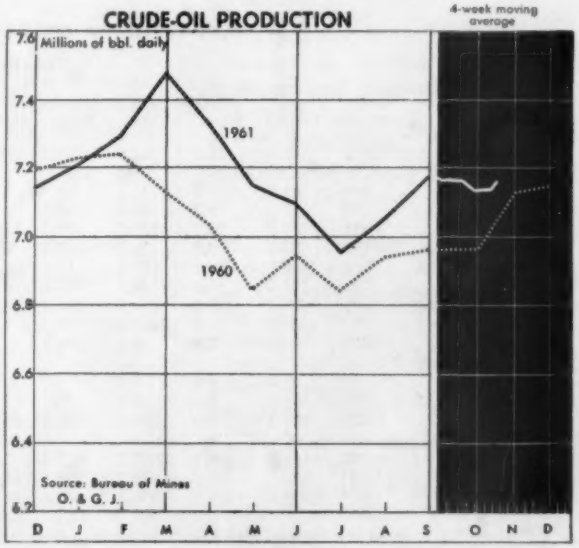
Daily average production for week

	November 18, 1961 Crude oil	Lease condensate	Total	Total
Alabama	18,750	.....	18,750	18,750
Alaska	25,500	.....	25,500	23,200
Arkansas	78,900	150	79,050	75,125
California	817,500	.....	817,500	816,000
Colorado	127,000	.....	127,000	126,400
Eastern	40,200	.....	40,200	41,400
Florida	1,000	.....	1,000	1,000
Illinois	220,200	.....	220,200	220,600
Indiana	30,900	.....	30,900	31,100
Kansas	305,035	.....	305,035	298,100
Kentucky	51,700	.....	51,700	51,700
Louisiana	1,045,000	165,750	1,210,750	1,210,750
Michigan	52,600	.....	52,600	52,500
Mississippi	146,000	4,200	150,200	150,200
Montana	88,700	.....	88,700	87,000
Nebraska	71,200	.....	71,200	71,400
Nevada	450	.....	450	450
New Mexico	310,000	9,000	319,000	319,000
North Dakota	56,900	.....	56,900	55,600
Oklahoma	515,000	.....	515,000	496,900
Texas	2,430,000	93,800	2,523,800	2,523,800
Dist. 1	43,000	2,900	45,900	45,900
Dist. 2	106,000	8,000	114,000	114,000
Dist. 3	306,000	38,000	344,000	344,000
Dist. 4	177,000	14,000	191,000	191,000
Dist. 5	26,000	850	26,850	26,850
Dist. 6	117,000	8,500	125,500	125,500
East Texas field	128,000	.....	128,000	128,000
Dist. 7-B	120,000	500	120,500	120,500
Dist. 7-C	107,000	3,550	110,550	110,550
Dist. 8	1,000,000	13,000	1,013,000	1,013,000
Dist. 9	195,000	2,500	197,500	197,500
Dist. 10	105,000	2,000	107,000	107,000
Utah	91,400	.....	91,400	90,850
Wyoming	411,900	.....	411,900	408,700
Others	‡825	.....	‡825	‡725
Total U. S.	6,936,660	272,900	**7,209,560**	7,171,310
Change from prev. week, up			**38,250**	
Canada	†643,000	†20,800	†663,800	†585,400

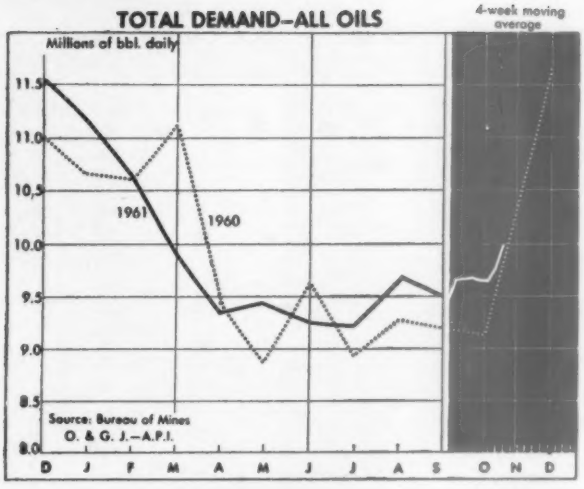
Total U. S. prod.—Jan. 1-Nov. 18 ..... 2,315,333,500 bbl.
Same period last year (crude plus cond.) ..... *2,267,216,400 bbl.

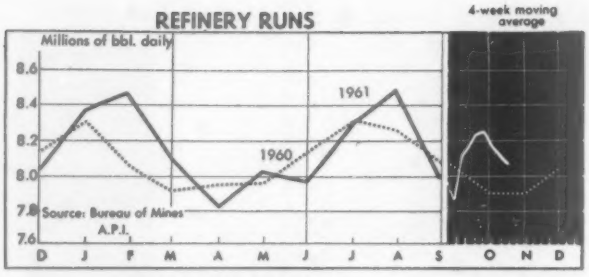
*Includes 72,931,200 bbl. condensate. †Week ended previous Monday. ‡South Dakota, Arizona, Missouri.

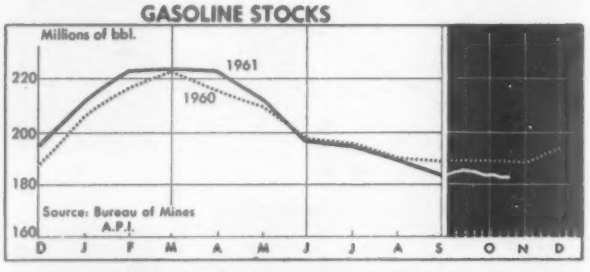
CRUDE-OIL PRODUCTION

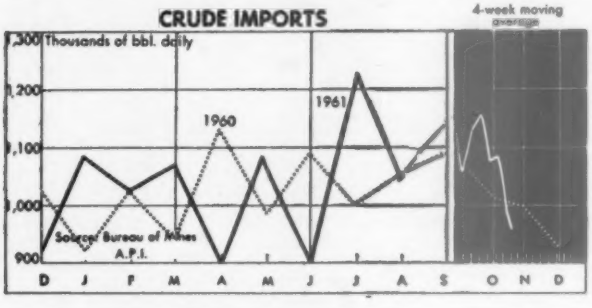


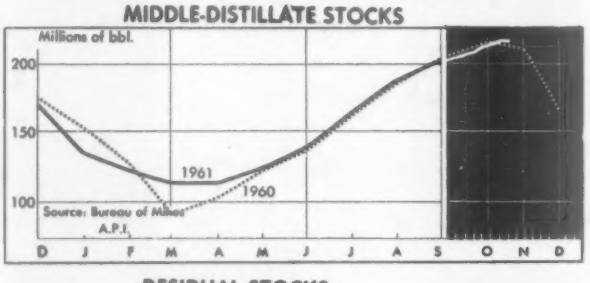
Refining

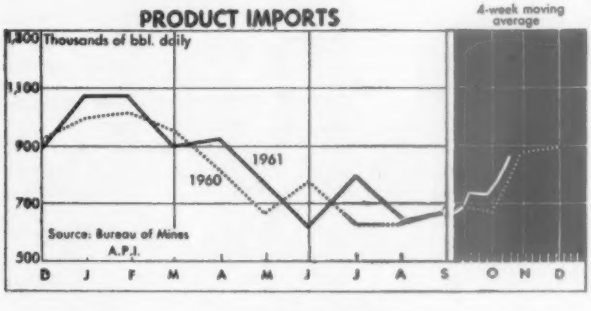


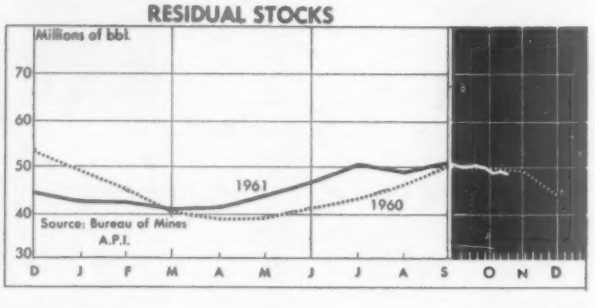












API refinery report—November 17, 1961

(Thousands of barrels)

District—	Daily avg. runs	Daily average production—Gaso.*	Kero.	Dist.	Resid.	Stocks‡—Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, November 1960—Daily avg. runs	Daily average production—Gaso.*	Kero.	Dist.	Resid.
East Coast	1,078	445.4	28.3	332.5	128.0	43,424	15,044	71,617	14,012	1,062	503.8	34.1	332.7	145.4
Appalachian:														
District 1	108	43.7	7.7	23.1	15.8	5,442	785	4,386	365	98	39.9	4.1	19.9	11.8
District 2	92	55.1	5.2	18.4	10.2	3,259	545	1,969	208	102	52.7	7.2	18.7	12.4
Ind., Ill., Ky.	1,581	769.0	68.8	357.0	178.7	30,606	7,423	31,441	5,920	1,429	735.5	80.4	313.5	167.4
Minn., Wis., Dak.	110	52.8	2.0	29.7	12.4	6,563	1,858	8,729	549	115	55.0	5.3	27.1	22.0
Okla., Kans., Mo.	701	406.2	14.1	173.6	17.5	16,139	1,664	13,287	951	706	410.9	11.0	176.5	19.3
Inland Texas	289	215.0	11.1	48.1	18.4	7,228	579	1,538	2,817	274	214.6	9.7	45.3	18.7
Texas Gulf Coast	1,817	986.7	119.2	514.7	104.3	23,471	3,339	18,125	5,091	1,881	968.9	140.1	457.8	135.7
La. Gulf Coast	717	389.4	71.7	167.6	38.9	8,955	1,846	7,378	1,189	645	358.7	73.0	143.5	39.9
N. La. and Ark.	116	62.2	4.8	26.6	6.5	6,125	760	2,851	208	108	68.2	5.8	21.4	7.3
Rocky Mountain:														
New Mexico	27	15.0	0.4	4.6	2.3	818	34	274	100	22	11.7	0.3	3.9	2.7
Other Rocky Mt.	293	136.0	6.0	68.0	35.5	5,050	566	2,335	1,191	280	140.9	3.5	67.7	33.6
West Coast	1,241	575.3	49.0	263.3	259.0	25,021	2,148	14,553	16,095	1,171	527.9	38.9	201.3	287.6
Nov. 17, 1961	8,170	4,151.8	388.3	2,027.2	827.5	182,101	36,591	178,483	48,696	7,893	4,088.7	413.4	1,829.3	903.8
Nov. 10, 1961	8,079	3,996.7	387.7	1,948.4	836.6	182,284	37,088	179,674	49,523	.....	.....	.....	.....	.....
Nov. 18, 1960	7,987	4,029.3	467.0	1,876.8	862.6	184,911	36,833	175,327	47,963	.....	.....	.....	.....	.....

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

CRUDE-OIL PRICES

Gravity schedule

	Signal Hill, Calif.	Oklahoma	West Tex. (sour)	West Tex. (inter.)	No.* Texas	Texas Refugio Light	Bayou Sale (La.)	Denver-Julesburg	Wyo. (sour)
14-14.9	$1.86	....	....	....	....	....	....	....	....
15-15.9	1.93	....	....	....	....	....	....	....	$1.81
16-16.9	2.00	....	....	....	....	....	....	....	1.86
17-17.9	2.06	....	....	....	....	....	....	....	1.91
18-18.9	2.13	....	....	....	....	....	....	....	1.96
19-19.9	2.20	....	....	....	....	....	....	....	2.01
20-20.9	2.27	$2.49	†$2.35	$2.61	$2.29	$2.95	$2.90	‡$2.38	2.06
21-21.9	2.33	2.52	2.38	2.63	2.33	2.97	2.92	2.40	2.11
22-22.9	2.40	2.55	2.41	2.65	2.37	2.99	2.94	2.42	2.16
23-23.9	2.46	2.58	2.44	2.67	2.41	3.01	2.96	2.44	2.21
24-24.9	2.53	2.61	2.47	2.69	2.45	3.03	2.98	2.46	2.26
25-25.9	2.60	2.64	2.50	2.71	2.49	3.05	3.00	2.48	2.31
26-26.9	2.67	2.67	2.53	2.73	2.53	3.07	3.02	2.50	2.36
27-27.9	2.74	2.70	2.56	2.75	2.57	3.09	3.04	2.52	2.49
28-28.9	2.81	2.73	2.59	2.77	2.61	3.11	3.06	2.54	2.54
29-29.9	2.87	2.76	2.62	2.79	2.65	3.13	3.08	2.56	2.59
30-30.9	2.93	2.79	2.65	2.81	2.69	3.15	3.10	2.58	2.63
31-31.9	3.00	2.82	2.68	2.83	2.73	3.17	3.12	2.60	2.67
32-32.9	3.06	2.85	2.71	2.85	2.77	3.19	3.14	2.62	2.71
33-33.9	3.12	2.88	2.74	2.87	2.81	3.21	3.16	2.64	2.75
34-34.9	3.17	2.91	2.77	2.89	2.85	3.23	3.18	2.66	2.79
35-35.9	3.22	2.94	2.80	2.91	2.89	3.25	3.20	2.68	2.83
36-36.9	3.27	2.97	2.83	2.93	2.93	3.27	3.22	2.70	2.87
37-37.9	3.31	2.99	2.86	2.95	2.95	3.29	3.24	2.72	2.89
38-38.9	....	3.01	2.89	2.97	2.97	3.31	3.26	2.74	2.91
39-39.9	....	3.03	2.92	2.99	2.99	3.33	3.28	2.76	2.93
40-44.9	....	3.05	2.95	3.01	3.01	3.35	3.30	2.78	2.95

*Cooke, Grayson, Montague. †Other posting starts at $2.55. ‡Some at 2.58.

FLAT PRICES

Louisiana:
- Sweet Lake $3.00

Texas:
- East Texas 3.10-3.25
- Conroe 3.23-3.53
- Van 2.93-3.08

Pennsylvania Grade:
- Bradford $4.80
- Middle District 4.52
- Southwest Pennsylvania ... 4.25
- West Virginia 4.17
- Buckeye Grade 4.08

Illinois Basin **3.00**

FOREIGN

Middle East, Persian Gulf: (cargoes f.o.b. lifting port)
- Arabian, 34.0°-34.9°, Ras Tanura $1.80
- Iranian, 34.0°-34,9°, Bandar Mashur 1.78
- Iranian, 34.0°-34.9°, Abadan 1.73
- Iraq, 35.0°-35.9°, Fao 1.72
- Kuwait, 31.0°-31.9°, Mina-al-Ahmadi 1.59
- Qatar, 41°-41.9°, Umm said 1.95

Middle East, E. Mediterranean:
- Arabian, 34.0°-34.9°, Sidon $2.17
- Iraq, Mosul-Kirkuk, 35.0°-35.9°, Tripoli 2.19
- Seria Light, 36° 2.42

Far East (cargoes, f.o.b. Lutong, Sarawak):

Canada:
- Leduc-Woodbend $2.63
- Redwater (Alta.) 2.52
- Weyburn (light) 2.185
- Midale C 1.89

Venezuela:
- Cumarebo, 47°-47.9°, Tucupido 3.34
- San Joaquin, 40°-40.9°, Puerto La Cruz 3.08
- Oficina, 35°-35.9°, Puerto La Cruz 2.80
- Tia Juana medium, 26°-26.9°, Amuay* 2.30
- Quiriquire, 16.0°-16.4°, Caripito 2.10
- Lagunillas heavy, flat, Las Piedras* 2.10
- Bachaquero, flat, 15°-16°, Las Piedras* 1.88

Price for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° vary 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

TANKER RATES (Long ton)

(Latest reported spot fixtures)

- ★ Gulf-NY, clean (ATRS+5%) $2.94
- ★ Gulf-NY, dirty (ATRS+10%) 3.14
- ★ Carib.-UK, clean (Scale—32.5%) (21s. 11d.) 3.07
- PG-Japan, dirty (USMC—65%) 3.57
- PG-UK, dirty (Scale—57.5%) (20s. 7d.). 2.72

★ Denotes change from previous week.

REFINED PRODUCTS

Following quotations are realistic spot prices for refined products moving interstate on Wednesday each week. They may differ from refinenrs' posted prices and should not be considered as postings.

Light-product prices are in cents per gallon. Residual and crude prices are dollars per barrel. Crude prices are at the well unless otherwise listed.

GASOLINE*

Mid-Continent (Group 3):
- Regular (91 octane) .. 10.25-10.50
- Premium (99 octane) .. 13.00-13.25
- †Natural gasoline (26-70) 4.5
- †Breckenridge 4.0

Gulf Coast (cargoes for coastwise or export movements): movements):
- Regular (90 octane) 10.50-11.00
- Regular (92 octane) 10.75-11.25
- Premium (98 octane) 11.75-12.25

California (rack) Los Angeles:
- Regular (90 octane) 11.20
- Premium (94 octane) 12.20
- Premium (100 octane) ... 13.35

Caribbean area (cargoes):
- Regular (87 octane) 9.00
- Premium (97 octane) 11.50

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

KEROSINE DISTILLATE

Mid-Continent (Group 3):
- ★ Kerosine 42-44 ..... 9.75-10.00
- ★ Diesel oil (58 d.i. and above) 9.25-9.50
- ★ Distillate No. 1 ..... 9.25-9.50
- ★ Distillate No. 2 ..... 8.50-8.75

Gulf Coast (cargoes):
- Kerosine 41-43 ..... 9.75
- Distillate No. 2 ..... 8.75

New York Harbor (barges):
- Kerosine 42-43 ..... 11.20
- Distillate No. 2 ..... 10.20
- Diesel fuel, 48-52 d.i. 10.35

Caribbean area (cargoes):
- Distillate No. 2 ..... 8.10

RESIDUAL FUEL

Mid-Continent (Group 3):
- Residual fuel (max. 1% S) $1.65-1.75

Gulf Coast (cargoes):
- Bunker C fuel 2.20

New York Harbor (barges):
- Bunker C fuel 2.52

Caribbean (cargoes):
- Bunker C fuel 2.00

California (rack):
- Bunker C fuel, Los Angeles 2.25

†Due to the decline in market for Grade 26-70 natural gasoline, The Oil and Gas Journal will discontinue publication of prices for this grade of natural gasoline at the end of 1961.

October wildcat completions highest since August at 791

State—	Total	Oil	Cond.	Gas	Dry	Footage	Cum. wells 1961	Cum. footage 1961
Alabama	0	0	0	0	0	0	8	86,469
Alaska	4	0	0	0	4	35,714	11	101,270
Arizona	1	0	0	0	1	876	11	30,552
Arkansas	9	0	0	0	9	38,274	90	357,885
California	25	0	0	2	23	164,207	224	1,436,628
Colorado	35	2	1	3	29	185,424	251	1,242,810
Florida	1	0	0	0	1	7,871	8	76,491
Georgia	0	0	0	0	0	0	1	4,500
Illinois	43	6	0	0	37	91,892	382	755,172
Indiana	31	2	0	0	29	45,409	175	233,735
Kansas	60	4	0	2	54	231,035	736	2,895,834
Kentucky	12	2	0	0	10	29,065	109	160,601
Louisiana	68	1	2	2	63	473,971	532	4,348,958
North	40	0	0	0	40	147,466	251	1,044,610
South	20	1	2	1	16	236,668	232	2,757,277
Offshore	8	0	0	1	7	89,837	49	547,071
Michigan	31	2	0	1	28	104,129	238	746,457
Mississippi	18	3	0	0	15	171,540	161	1,590,658
Missouri	1	0	0	0	1	2,631	34	58,850
Montana	20	1	0	0	19	86,485	158	815,540
Nebraska	33	1	0	0	32	164,171	403	1,884,650
Nevada	0	0	0	0	0	0	13	19,643
New Mexico	26	9	0	0	17	130,272	246	1,309,473
West	10	4	0	0	6	41,956	80	248,115
East	16	5	0	0	11	88,316	166	1,061,358
New York	6	0	0	3	3	17,402	18	56,032
North Dakota	10	0	0	0	10	51,783	60	390,676
Ohio	2	0	0	1	1	8,308	36	120,877
Oklahoma	31	3	2	3	23	151,331	446	2,332,585
Oregon	0	0	0	0	0	0	2	15,295
Pennsylvania	8	0	0	4	4	45,478	44	281,835
South Dakota	0	0	0	0	0	0	5	30,908
Tennessee	0	0	0	0	0	0	65	49,593
Texas	265	26	4	22	213	1,477,941	2,554	13,172,594
District 1	33	1	0	1	31	101,096	311	1,043,001
District 2	24	2	1	5	16	194,555	187	1,312,450
District 3	15	0	0	1	14	137,969	184	1,723,266
District 4	44	4	0	8	32	258,741	266	1,587,898
East (5 & 6)	19	1	1	0	17	141,600	250	1,327,986
District 7-B	34	6	0	1	27	109,459	414	1,447,452
West (7-C & 8)	45	8	1	3	33	262,494	590	2,957,300
District 9	33	2	0	0	31	146,052	243	967,518
District 10	18	2	1	3	12	125,975	109	805,723
Utah	11	0	1	1	9	69,419	92	539,304
Washington	1	0	0	0	1	3,009	11	44,404
West Virginia	1	0	0	1	0	10,805	8	66,300
Wisconsin	0	0	0	0	0	0	6	8,100
Wyoming	38	1	1	1	35	220,969	313	1,738,750
Total October 1961	**791**	**63**	**11**	**46**	**671**	**4,019,411**	**7,451**	**37,003,429**
Total September 1961	721	67	7	27	620	3,732,160	....	....
Cum. 1961	**7,451**	**662**	**80**	**339**	**6,370**	**37,003,429**	....	....
Cum. 1960	8,036	723	87	272	6,954	36,941,501	....	....

October completions in western Canada

	All wells							Wildcats					
	Total	Oil	Gas	Dry	Service	Footage	1961 cum.	Total	Oil	Gas	Dry	Footage	1961 cum.
Total	**242**	**140**	**44**	**57**	**1**	**1,297,876**	**1,966**	**41**	**3**	**9**	**29**	**219,431**	**462**
Alberta	155	80	29	45	1	964,150	1,290	33	3	5	25	185,045	331
Saskatchewan	62	48	4	10	0	215,848	502	5	0	2	3	15,344	55
Manitoba	0	0	0	0	0	0	23	0	0	0	0	0	8
British Columbia	25	12	11	2	0	117,878	136	3	0	2	1	19,042	53
Northwest Territories	0	0	0	0	0	0	15	0	0	0	0	0	15

October footage breakdown in western Canada

	Field wells				Wildcats		
	Oil	Gas	Dry	Service	Oil	Gas	Dry
Total	**779,138**	**156,327**	**137,243**	**5,737**	**15,990**	**37,987**	**165,454**
Alberta	557,392	109,911	106,065	5,737	15,990	19,001	150,054
Saskatchewan	170,438	3,246	26,820	....	....	4,244	11,100
British Columbia	51,308	43,170	4,358	....	....	14,742	4,300

CLASSIFIED ADVERTISING

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RATES:

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- All classified payable in advance.

- DEADLINE: Copy to reach The Oil and Gas Journal not later than 9 a. m. on Wednesday preceding date of publication. Send advertisements to: Classified Advertising Manager, THE OIL AND GAS JOURNAL, P. O. Box 1260, Tulsa 1, Oklahoma.

EXCEPT . . .

WESTERN STATES: (California, Washington, Oregon, Idaho, Nevada, Utah, and Arizona). Write: Classified Departments, Inc. The Oil and Gas Journal, 4041 Marlton Ave., Los Angeles 8, Calif. Phone AXminister 2-0287. Copy deadline Monday noon.

FOR SALE EQUIPMENT

20,000 FEET 4½" O.D. used 10.79# double random pipe, PE and beveled for welding, tested 1000#, priced reasonable. Call CE 5-1454, Oklahoma City, collect.

50,000 FT. 20 inch No. 1 grade used pipe. Lengths 20 ft. square cut ends. Weight 78# to the ft. High Tensile Pipe. Indiana-Ohio Pipe Co., P. O. Box 5462 Shep. Sta., Columbus 19, Ohio. Phone CL 3-5527—CL 3-5538.

AN INVESTMENT! Productive advertising is an investment rather than an expenditure. Experienced oil men have found that The Oil and Gas Journal is their best classified advertising medium.

2500 FAILING, 5 x 8 pump, 56' mast. Failing 1500, Howard Turner, complete. Fred Butler, Box 481, Pueblo, Colo.

2,000'—24" OD New, ¼" Wall
Prime Pipe, 50', B.F.W., P.E.
@ $_____
10,000'
18" x 5/16" ditto
@ $_____
Prompt Shipment From Stock
F.O.B. Columbus, Ohio
Columbus Steel Supply Company
1000 Bonham Avenue
Columbus 3, Ohio AX 4-4461

FOR SALE:

4—36-L Bucyrus Erie drilling machines skid mounted Waukesha engines.
1—1957 model W 226 Cooper two drum servicing unit with spudding attachment, air clutches 8 x 10 mast, mounted on International Tandem truck
1—1955 model Franks junior drum servicing unit with 7 x 8 mast mounted on a Studebaker truck
1—Franks 5,000 single drum servicing unit, air clutch, 5 x 7 double pole mast mounted on L-192 International Tandem truck.
These units are in good operating condition and are priced for quick sale.

Degen Pipe & Supply Co.
4900 Sapulpa Road, Tulsa, Oklahoma
Phone HIckory 6-6152

LIQUIDATION

at ESSO REFINERY Balto., Md.

MOST EQUIPMENT NEW 1956

TOWERS	• COMPRESSORS
DRUMS	• BLOWERS
FURNACES	• TRANSFORMERS
PUMPS	• MOTORS
CONDENSERS	• FURNACE TUBES

WRITE FOR CATALOG

HEAT & POWER CO., INC.
60 East 42nd St., New York 17, N. Y.
310 Thompson Bldg., Tulsa, Okla.

FOR SALE EQUIPMENT

USED DRILLING Derrick and substructure 30' x 30' x 140' Lee C. Moore Single Well Galvanized Derrick 1,100,000# and 100 MPH Wind Capacities. 30' base, truss type API Galvanized Substructure. The California Company, 1111 Tulane Avenue, New Orleans 12, Louisiana.

(6) 96,000 Bbl. 120'x48'

WELDED CONE ROOF
OIL STORAGE TANKS
INSTALLED NEW in 1952
Dismantled, Matchmarked For
Reerection $75.00 N.T.
FOB Baltimore, Md.

HEAT & POWER CO., INC.
60 East 42nd St., New York 17, N.Y.
Boston & Haven Sts., Baltimore 24, Md.

AT N. LITTLE ROCK, ARKANSAS

3—Worthington #L T C-4, compressors, 3500 CFM @ 45 PSI, 24 x 15, 2-cyl., 500 HP, 4-cycle, gas-engine drive.
Phone POplar 3-3503

PERRY EQUIPMENT CORP.
1402 N. Sixth St.
Philadelphia 22, Pa.

90,000 feet
of 8⅝" O.D. 28.55#
P.E. #1 Used line pipe
located near Ada, Oklahoma.
Phone: 425-2447
A. A. Gilbert Pipe & Supply Co.
P. O. Box 986, Shreveport, Louisiana

PERFORATING & LOGGING EQUIPMENT

- **HOIST UNITS**
  NEW AND USED
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- **PERFORATING**
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  SETTING TOOLS, PLUGS, PACKERS AND DUMP BAILERS

FOR CATALOG AND PRICES WRITE TO:

GO PERFORATOR SUPPLY
Box 1936, Fort Worth, Texas
FOREIGN AND DOMESTIC SALES

FOR SALE EQUIPMENT

SIE, 24 TRACE, dual record, GA7-G Seismic system complete. Mounted on 1958, 2 ton Chevrolet truck, front end winch. Other equipment also available. Texas Seismograph Co. Box 2069, Phone 723-1493, Wichita Falls, Texas.

USED GAS PROCESSING Equipment; Glycol and Dry Dessicant Dehydrators; Quick-cycle Hydracarbon Recovery Units; Water Flood Filter-pump Units. Also new oil and gas production equipment. Engineered Specialties Co., P. O. Box 35683, Phone FL 1-5284, Dallas 35, Texas.

A CLASSIFIED ad run in this section in the November 20 issue indicated that Beckman Company, Muskogee, Oklahoma, has quit business. This is not correct. This well service contracting firm has been in business for over 20 years and is currently operating as usual.

LARGE SCINTILLOMETER and recorder, 5" Crystal—115V. Truck Mounted. Leonard Combs, 1115 South Quebec, Tulsa 12, Okla.

4—5¾" x 50' and 1—4½" x 50' core barrels with all spare parts and equipment. All equipment in excellent condition. Box M-630, The Oil and Gas Journal, Tulsa, Oklahoma.

1—XOB Ingersoll-Rand Compressor with 2—10" cylinders. 1—970 Buda 6 cylinder gas engine. 1 Model 6 WAKU Waukesha gas engine. All reshopped. Also Bessemer, Clark, Cooper compressor cylinders. Nolan Sales Corporation, 421 N. Cincinnati, Tulsa, Okla.

R L CARDWELL double drum spudder—GKU power with 93' derrick. Ready to work—bargain—will trade for casing or tubing. Call collect CE 5-1454 Oklahoma City.

EQUIPMENT WANTED

WANTED:
PUMPING UNITS

160,000 IPT Double reduction No. 1 Used Pumping Units needed at Gorham, Kansas. Give complete description, make and date of manufacture. Quote price present location, also price delivered. Contact H. D Lawver, Home-Stake Production Co., 2301 Philtower Bldg., Phone LU 4-5281, Tulsa, Oklahoma.

HELP WANTED

MECHANICAL ENGINEER

Houston Manufacturing Company needs graduate M.E. with 3 to 5 years drilling, completion and production experience for Development Engineer position. Challenging work with commensurate salary for man with creative capabilities. Fringe benefits equal to major oil companies. Send resume to:

Box M-631

The Oil and Gas Journal
Tulsa, Oklahoma

HELP WANTED

TRANSLATORS-ENGINEERS WANTED—Proven ability to translate technical material into fluent English essential. Attractive full time or free-lance arrangement. All languages of interest, particularly Russian & Japanese. Send resume to: A•T•S, Inc., Drawer 271, East Orange, N. J.

DRILLING ENGINEER—Drilling contractor, Rocky Mountain area. Opening for graduate engineer. Experience with drilling equipment, techniques required. Send complete resume. All replies confidential. Box M-648, The Oil and Gas Journal, Tulsa, Oklahoma.

EXPLORATION COMPANY active in Appalachians will train young college graduate for career in oil business as landman. Send full particulars: Joe Jamar, 507 Commonwealth Bank Bldg., Butler, Pa.

WANTED: Petroleum or Mechanical Engineer for oil tool design. Experience with the operation of downhole equipment is desirable. State age, education, experience and salary expected. Box M-643, The Oil and Gas Journal, Tulsa, Oklahoma.

NATURAL GAS production clerk for Northern California. Duties will consist of gas chart integrator operation. Posting of data and typing. Experience on chart integrator desirable. Enclose qualifications, personal data and salary expected. Contact: Cameron Oil Company, Box 98, Meridian, California.

PROJECT ENGINEERS
NEED EXPERIENCED MECHANICAL ENGINEERS IN ANY OF THE FOLLOWING FIELDS:
MUD PUMP PARTS
VALVE DESIGN
PIPELINE COATING
PERCUSSION BITS
Location—HOUSTON, TEXAS, with established firm. Send resume to Box M-639, THE OIL AND GAS JOURNAL, Tulsa, Oklahoma

MECHANICAL ENGINEER

5 years experience in multi-staged high compression engines. Major chemical plant in southern location. Salary commensurate with qualifications. Age 25-35. Send resume to W. R. Hayes:

MONSANTO CHEMICAL COMPANY
Agricultural Chemicals Division
St. Louis 66, Mo.

SENIOR PROCESS ENGINEER

Experience required in designing all types of refinery process units. Splendid opportunity to advance with engineering and construction firm having world-wide representation. All replies held in strict confidence. Address or call collect:

Mr. Harry Litwin
LITWIN ENGINEERING CO.
204 N. Waco
Wichita, Kansas

REFINERY
CHEMICAL ENGINEERS
SOUTH AMERICA

Desired for opportunities in modern refineries of an affiliate of STANDARD OIL COMPANY (NEW JERSEY) operating in South America. Candidates must be graduate Chemical Engineers with 5 to 10 years refinery experience and a thorough knowledge of process design and process control. Opportunities exist for assignments to Economics, Lubricants and Oil Movement, and Distillation Sections of Process Engineering Group as well as the Laboratory Group and Operating and Maintenance Groups. Salary including bonus from $15,000 to $17,000 annually depending upon experience. Liberal employee benefits including annual home vacations with travel allowance. Interviews will be arranged for qualified candidates. All replies confidential. Send complete resume' of work experience and personal data to:

P. O. Box 518, Department E
Radio City Station
New York 19, New York

HELP WANTED

OIL JOB DIRECTORY, foreign and domestic, showing where to apply for jobs $5.00 cash OIML Co., Box 2603, Tulsa, Oklahoma.

PLASTIC PIPE manufacturer wants young man (25-30) of proven sales ability with engineering degree. Telsco Industries, Box 18205, Dallas 18, Texas.

PROJECT ENGINEERS

Graduate Electrical and Civil Engineers with 5 to 8 years' experience in detail design of pipeline and plant facilities. Continued growth and diversification of this major company requires supervisory potential. Permanent position with excellent salary and benefits. Pleasant friendly city with good schools and housing. All qualified applicants will be considered regardless of race, color, creed or national origin. Submit resume with complete salary history to: J. Alan Hansen, Northern Natural Gas Company, P. O. Box 306, Omaha, Nebraska.

SITUATIONS WANTED

PETROLEUM ENGINEER, 37. Experienced drilling, production, reservoir, valuation, waterflooding. Licensed pilot. Box M-646, The Oil and Gas Journal, Tulsa, Oklahoma.

GRADUATE ENGINEER—Age 32, family. Eight years with the same company. Experience in drilling, production, reservoir engineering, and evaluation. Looking for opportunity. Box M-633, The Oil and Gas Journal, Tulsa, Oklahoma.

PRODUCTION MAN thoroughly experienced in producing properties, well completions, and workovers wants position as production foreman or superintendent with growing independent. References upon request. Will relocate. Box M-621, The Oil and Gas Journal, Tulsa, Oklahoma.

REGISTERED Petroleum Engineer—36, married. Fifteen years diversified experience from roughneck to production and drilling supervisor—Rio Grande to Mississippi, plus Foreign. Desire to return to the States. Box M-625, The Oil and Gas Journal, Tulsa, Oklahoma.

ASPHALT SALES manager available because of impending merger. Over twenty successful years in engineering, marketing and promotion of highway and industrial asphalts. Present employer will discuss my background and capabilities. Please reply in confidence to Box M-645, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST, BS, 5 years experience in South Louisiana. Desires position with aggressive independent company. Box M-642, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOPHYSICIST, 39, prefers overseas assignment. Most recently chief geophysicist of foreign company. Resume on request. Box M-641, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST, 29, M.S., 4 years experience in Williston Basin. Subsurface mapping and carbonate studies. Desires position in exploration or research. Box M-636, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGICAL CONSULTANT

Ten years West Texas and New Mexico, desires retainer to represent individual or group in the Permian Basin. Box M-632, The Oil and Gas Journal, Tulsa, Oklahoma.

White Space
DOES
Increase
Readership
Use It!

LEASE AND DRILLING BLOCKS

ARIZONA—Big "Helium" lease play. Leases Available near Majors $1.00 acre. Terms—Free Maps. Edward Colson, 1716 W. Devonshire, Phoenix, Arizona.

STARTING offset well to new Bartlesville Well just completed. Need three associates to drill and develop this joining lease. We own the new well we are offsetting. S & M Production Co., Box 59, Cherryvale, Kansas.

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FIVE WELLS, Seminole County, Oklahoma. 30 BOPD, offsetting new water flood. Engineering Reports. No Brokers. Box M-634, The Oil and Gas Journal, Tulsa, Oklahoma.

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LEGAL

SALE OF OIL AND GAS mining leases, allotted Indian lands, Department of The Interior, Bureau of Indian Affairs, Fort Peck Indian Agency, Poplar, Montana. Sealed bids will be received until 9:00 A.M., Mountain Standard Time, December 14, 1961, and opened at that time at the Fort Peck Indian Agency, Poplar, Montana, for the leasing of 8 tracts of individually owned trust or restricted Indian lands, comprising 1,439.52 acres located in Roosevelt and Sheridan Counties, Montana, for oil and gas mining purposes. Details of the lease offering and how and where to file bids may be obtained by addressing the inquiry to the Superintendent, Fort Peck Indian Agency, Poplar, Montana, or telephone Poplar, 768-3441.

LEGAL

THE FOLLOWING announcement is made by virtue of the powers vested in the Ministry of Finance by Order No. 1 of 1943, as amended. 1. The areas situated within the boundaries of District 1 and District 2 as described below are declared as "open" for the submission of proposals for the award of petroleum concessions therein for a period of three (3) months from Dec. 5th, 1961 ("zero date"). 2. (a) Boundaries of District 1: Commencing at the intersection of latitude 16° North and longitude 41° 20′ East; thence South along longitude 41° 20′ East in a straight line to the intersection of latitude 14° 45′ North and longitude 41° 20′ East; thence West along latitude 14° 45′ North to the intersection of latitude 14° 45′ North and longitude 40° East; thence in a North-Westerly direction in a straight line to the intersection of latitude 15° 35′ North and longitude 39° 15′ East; thence in a North-North-Westerly Direction to the intersection of latitude 16° North and longitude 39° 05′ East; thence East along latitude 16° North to the point of origin, the area enclosed in said boundaries being approximately 27,500 square kilometers in area. (b) Boundaries of District 2: Commencing at the intersection of latitude 18° 10′ North and longitude 38° 45′ East; thence in a South-South-Easterly direction to the intersection of latitude 17° 12′ North and longitude 39° 14′ East; thence East along latitude 17° 12′ North to the intersection of latitude 17° 12′ North and longitude 39° 41′ East; thence South-East in a straight line to the intersection of latitude 16° North and longitude 41° 21′ East; thence West along latitude 16° North to the intersection of latitude 16° North and longitude 39° 05′ East; Thence North-North Westerly in a straight line to the intersection of latitude 17° 30′ North and longitude 38° 40′ East; Thence North-North-Westerly in a straight line to the border between the Empire of Ethiopia and Republic of Sudan; thence along said border to the coast of the Red Sea; thence in a North-Easterly direction in a straight line to the point of origin, the area enclosed in said boundaries being approximately 27,000 square kilometers in area. 3. Any company ("applicant company") desiring to submit a proposal or proposals looking to the award of a concession covering either or both of the Districts described above shall notify the Ministry of Mines in writing. Upon said notification, and against payment of U. S. $1,000 for each District with respect to which requested, the applicant company shall be furnished with all documents required to permit the preparation of a proposal including a form of Contract of Concession, and instructions relating to the procedure to be followed in submitting proposals, and other documents. In addition, information as to exploration activities already carried on within each such District shall be made available to the applicant company. 4. Prior to ("zero date plus three months") proposals may be filed by the applicant company in accordance with the prescribed procedure. All proposals filed before (above date) shall be deemed to be filed simultaneously but shall not, however, create or vest any right in the applicant company, the Imperial Ethiopian Government reserving full right to reject any and all proposals received without cause. 5. All proposals shall be opened in public on ("zero date plus three months and one day"). Address: Ministry of Mines, P. O. Box 486, Addis Ababa, Ethiopia. Ministry of Mines, Imperial Ethiopian Government.

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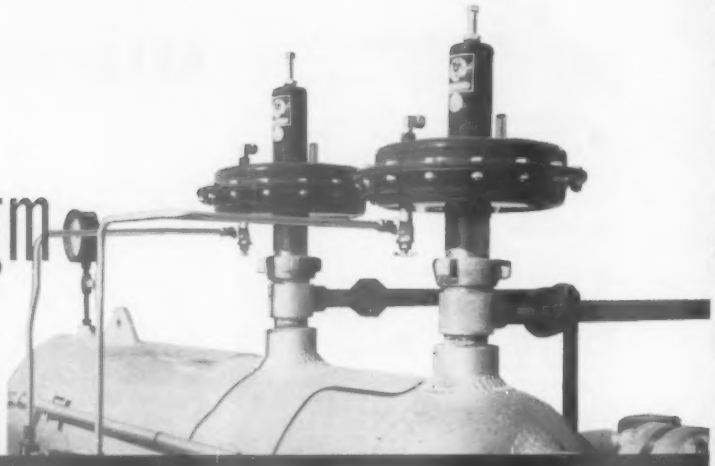

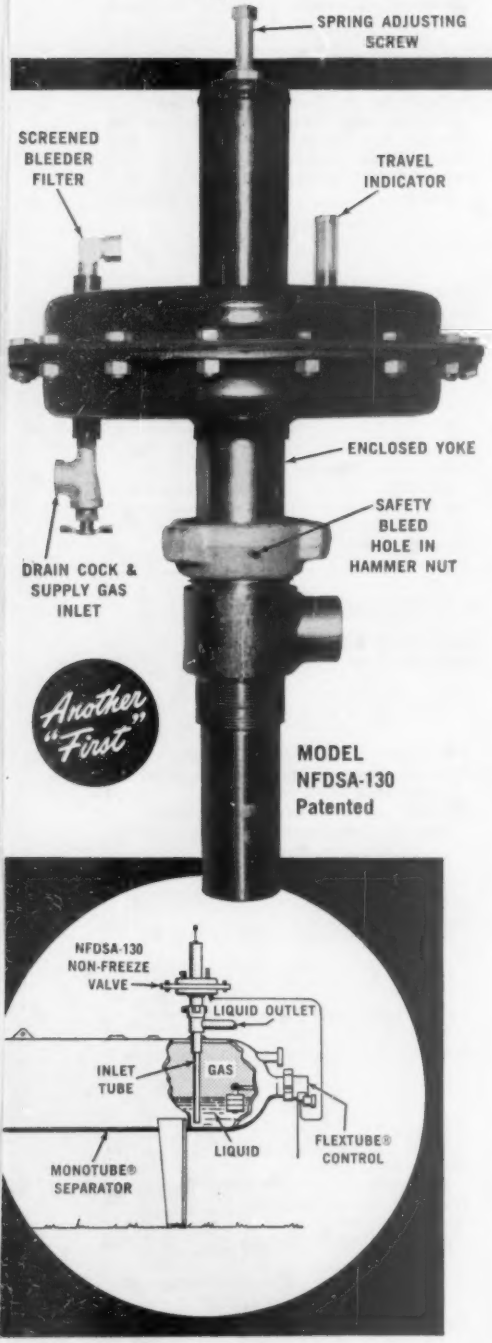

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- Hammer nut provided with safety bleed.
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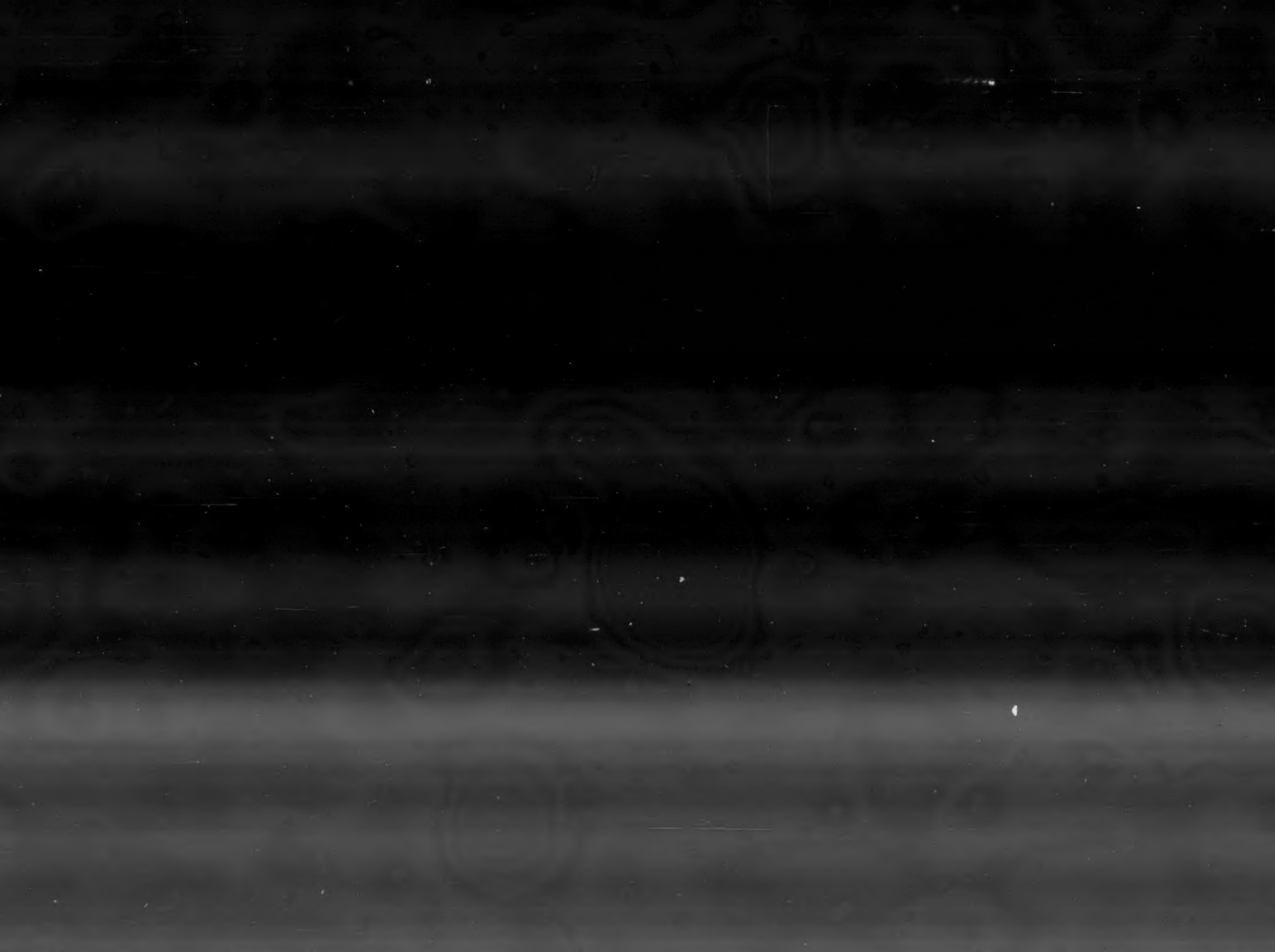
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